

















ANNALS

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W. J. HOLLAND, *Editor*

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## TABLE OF CONTENTS.

	PAGES.
Title-page and Table of Contents . . . . .	i-iv
List of Plates . . . . .	v-vi
List of Figures in Text . . . . .	vii
Errata et Corrigenda . . . . .	viii
Editorial Notes . . . . .	1-6, 309-314
I. Description of a New Species of Tortoise from the Jurassic of Utah. By Charles W. Gilmore . . . . .	7-12
II. The Fauna of the Upper Devonian in Montana. By W. P. Haynes . . . . .	13-54
III. Description of a New Sphagebranchus from the Bahamas. By Carl H. Eigenmann . . . . .	55-56
IV. Some Marine Fishes from Colombia and Ecuador. By Charles Wilson . . . . .	57-70
V. On Apareiodon, a New Genus of Characid Fishes. By Carl H. Eigenmann . . . . .	71-76
VI. New and Rare Fishes from South American Rivers. By Carl H. Eigenmann . . . . .	77-86
VII. Description of Three New Species of Characid Fishes. By Carl H. Eigenmann and Arthur W. Henn . . . . .	87-90
VIII. On the Species of Salminus. By Carl H. Eigenmann . . . . .	91-92
IX. On Various South American Pœciliid Fishes. By Arthur W. Henn . . . . .	93-142
X. A New Species of Apatosaurus. By W. J. Holland . . . . .	143-145
XI. The Birds of the Isle of Pines. By W. E. Clyde Todd . . . . .	146-296
XII. The Reptiles and Amphibians of the Isle of Pines. By Thomas Barbour . . . . .	297-308
XIII. A List of the Land and Fresh-water Shells of the Isle of Pines. By John B. Henderson . . . . .	315-324
XIV. The Pelecypoda of the Chazy Formation. By Percy E. Raymond . . . . .	325-343
XV. South American Crickets, Gryllotalpoidea, and Achetoidea. By Lawrence Bruner . . . . .	344-428
XVI. A Preliminary Catalog of the North American Sphæriidæ. By Victor Sterki, M.D. . . . .	429-477
XVII. Some Directions and Suggestions for Collecting the Sphæ- riidæ and Aquatic Gastropods. By Victor Sterki, M.D. . . . .	478-486

XVIII.	The Lepidoptera of the Isle of Pines, being a List of the Species Collected on the Island by Mr. J. L. Graf and Mr. G. A. Link, Sr., in 1910 and 1912-1913. By W. J. Holland . . . . .	487-518
XIX.	A List of the Odonata Collected on the Isle of Pines by Mr. J. L. Graf in 1910, and by Mr. G. A. Link in 1912-1913, now Contained in the Carnegie Museum. By Hugo Kahl.	519-526
XX.	A Trip to Islands in Lake Erie. By Calvin Goodrich. . . . .	527-531
XXI.	Notes on the Land-shells of the Islands at the Western End of Lake Erie and Description of New Varieties. By George H. Clapp . . . . .	532-541
XXII.	A List of the Orthoptera Collected in the Isle of Pines by J. L. Graf, 1910, and G. A. Link, 1912-1913. By W. J. Holland and Hugo Kahl . . . . .	542-546
	Index . . . . .	547-576



## LIST OF PLATES.

- I. Carapace and Plastron of *Glyptops utahensis* Gilmore, Type.
- II. Carapace and Plastron of *Glyptops utahensis* Gilmore, Paratype.
- III. Geologic Map of Region about Three Forks, Montana.
- IV. Columnar sections of the Three Forks formation.
- V-VIII. Brachiopods from Green Shales, Montana.
- IX. *Sphagebranchus conklini* Eigenmann, Type.
- X. *Umbrina tumacoënsis* Wilson, Type.
- XI. *Apareiiodon affinis* (Steindachner), Type of *Parodon paraguayensis* Eigenmann; *Apareiiodon itapicuruënsis* Eigenmann, Type.
- XII. *Apareiiodon hasemani* Eigenmann, Type.
- XIII. *Agoniates anchovia* Eigenmann, Type.
- XIV. *Corydoras meta* Eigenmann, Type; *Otocinclus spectabilis* Eigenmann, Type, inferior and superior views.
- XV. *Gnathocharax steindachneri* Fowler.
- XVI. *Stethaprion crenatus* Eigenmann, Type.
- XVII. *Hemiodus parnaguæ* Eigenmann & Henn, Type.
- XVIII. *Rivulus compressus* Henn, Type; *Phalloceras caudomaculatus* (Hensel).
- XIX. *Diphyacantha chocoënsis* Henn, Type and Paratype; *Limia hollandi* Henn, Type; *Neoheterandria elegans* Henn, Type and Paratype.
- XX. *Heterandria hasemani* Henn, Type; *Phalloptychus eigenmanni* Henn, Type and Paratype.
- XXI. *Phallotorynus fasciolatus* Henn, Type and Paratype.
- XXII. Casas Mountains near Nueva Gerona; Jungle on upper slopes of Caballos Mountains, Isle of Pines.
- XXIII. Palmetto-pine Scrub; Grove of Royal Palms; Bottle Palms, Isle of Pines.
- XXIV. Grove of Caribbean Pines near McKinley, Isle of Pines; Mangroves and grass along river-bank, Isle of Pines.
- XXV. Characteristic view in the Cienaga; Sea-cliffs at Punta del Este, Isle of Pines.
- XXVI. Cuban Nighthawk, *Chordeiles virginianus minor* (Cabanis) on nest, Santa Barbara, Isle of Pines.
- XXVII. Map of the Isle of Pines, West Indies.

- XXVIII. Lateral view of anterior portion and dorsal view of top of head of  
*Leimadophis nebulatus* sp. nov.  
Lateral view of anterior portion and dorsal view of top of head of  
*L. andreae*.
- XXIX. Pelecypoda of the Chazy Formation.
- XXX. Pelecypoda of the Chazy Formation.
- XXXI. Lepidoptera of the Isle of Pines.
- XXXII. Shells from the Western Islands of Lake Erie.
- XXXIII. Diagrams showing diameters and heights of *Pyramidula strontiana*  
and *P. roseo-apicata* Clapp.
- XXXIV. Diagrams showing diameters and heights of *Pyramidula alternata*  
*eriensis* Clapp.
- XXXV. Diagrams showing diameters and heights of *Polygyra profunda*  
*strontiana* Clapp.
- XXXVI. Diagram of diameters and heights of *Polygyra albolabris goodrichi*  
Clapp. Mr. Bryant Walker collecting *Polygyra goodrichi* on  
Middle Sister Island. Mr. George H. Clapp collecting shells on  
Middle Sister Island.



## LIST OF FIGURES.

	PAGES.
<i>Glyptops utahensis</i> . Carapace of type . . . . .	9
<i>Glyptops utahensis</i> . Plastron of type . . . . .	10
Mouth of <i>Agoniates anchovia</i> Eigenmann . . . . .	78
Predorsal spine of <i>Stethaprion crenatus</i> Eigenmann . . . . .	81
Scale of <i>Stethaprion crenatus</i> Eigenmann . . . . .	81
Diagrammatic sketch of <i>Pæcilia vivipara</i> , ♂, showing modification of last two precaudal vertebræ to form a support for intromittent organ . . . . .	98
<i>Diphyacantha chocoënsis</i> Henn, distal end of intromittent organ . . . . .	114
<i>Priapichthys nigroventralis</i> (Eigenmann & Henn), distal end of intro- mittent organ . . . . .	115
<i>Heterandria formosa</i> Agassiz, distal end of intromittent organ . . . . .	116
<i>Neoheterandria elegans</i> Henn, distal end of intromittent organ . . . . .	117
<i>Pseudopæcilia fria</i> (Eigenmann & Henn), distal end of intromittent organ . . . . .	119
<i>Pæcilopsis amates</i> (Miller), distal end of intromittent organ . . . . .	120
<i>Phallotorynus fasciolatus</i> Henn, side view and anal fin of male . . . . .	126
<i>Phallotorynus fasciolatus</i> Henn, inferior view of premaxillaries with teeth . . . . .	127
<i>Phallotorynus fasciolatus</i> Henn, view from above of terminal portion of anal; view from below of same object . . . . .	128
<i>Phallotorynus fasciolatus</i> Henn, section through center of terminal of anal; section through posterior portion of terminal part or scoop of the anal. . . . .	128
<i>Pæcilia melanzona</i> (Eigenmann), distal end of anal of male . . . . .	133
<i>Mollienisia latipinna</i> Le Seur, distal end of anal of male . . . . .	135
<i>Mollienisia caucana</i> (Steindachner), distal end of anal of male . . . . .	136
<i>Limia hollandi</i> Henn, distal end of anal of male . . . . .	137
Method of making a cheap ring for a net for collecting small mollusks. . . . .	480

## ERRATA ET CORRIGENDA.

- P. 25, 5th line from top, for "*læna*" read *leana*.  
P. 39, 3rd line from bottom, and 40, 14th line from bottom, for "*kellogi*" read *kelloggi*.  
P. 71, 10th line from bottom, for "*hasemanni*" read *hasemani*.  
P. 158, 22nd line from bottom, for "*Pharacrocorax*" read *Phalacrocorax*.  
P. 323, 17th line from bottom, for "*auricola*" read *auricoma*.  
P. 353, 7th line from top, for "*oxydactyla*" read *oxydactylus*.  
P. 377, 19th line from bottom, for "*Anurogyllus*" read *Anurogryllus*.  
P. 396, 23rd line from bottom, for "*immaculata*" read *immaculatus*.  
P. 405, 1st, 2nd, and 5th lines from top, for "*angusticollis*" read *angusticollis*.  
P. 427, 15th line from bottom, for "*Hapithes*" read *Hapithus*.  
P. 530, 16th line from top, for "(Draper)" read (Drapernaud).  
P. 530, 22nd line from top, for "Giddings" read Gould.  
P. 531, 3rd line from bottom, for "*Mousensis*" read *mynesites*.  
P. 544, for "ÆDIPODIDÆ" read CÆDIPODIDÆ.





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## EDITORIAL NOTES.

THE month of May and the first two weeks in June were spent by the Director on the Pacific coast, whither he had gone at the invitation of the authorities of the Panama-Pacific International Exposition, to act as a member of the International Jury in the Department of Education. The work of the Jury was more or less exacting, so that little time could be devoted to anything else. Nevertheless a visit to the University of California on Commencement Day, and a visit to Leland Stanford University on Baccalaureate Sunday, permitted the Director to renew his acquaintance with Professor J. C. Merriam at Berkeley and to inspect the wonderful paleontological collections which he has acquired, and to enjoy the hospitality of Dr. and Mrs. D. Starr Jordan at Palo Alto, and to glance at the ichthyological treasures in the Museum of the University.

After his work as a member of the Jury had been completed, the Director was able to find time to view the Yosemite, where he spent a couple of days, and then to repair to Los Angeles and San Diego. Near Los Angeles the remarkable deposit at Rancho la Brea was inspected. The kindness of Dr. Frank S. Daggett, the Director of the beautiful Museum of History, Science, and Art of Los Angeles County, on the occasion of a visit paid to the institution, will never be forgotten. The action of the authorities of Los Angeles County in appropriating a sum of money for the thorough scientific exploitation of the fossil Beds at Rancho la Brea is most gratifying as an illustration of in-

telligent interest in scientific matters. The wonderful results in the recovery of vast numbers of splendid specimens representing the Pleistocene fauna of California, is most remarkable. The researches of Professor Merriam, now being followed up by the work of Dr. Daggett and his associates, will reveal the life which existed in Pleistocene times upon the Pacific coast in a manner unparalleled by any similar work. The number of species of mammals and birds preserved in these asphalt beds is astonishingly large, and we impatiently wait for the publications, which are in course of preparation, and which will give in detail an account of the discoveries made.

From Los Angeles the Director proceeded to Utah, where he viewed the Carnegie Quarry near Jensen, spending some time with Mr. Douglass going over the work which has been accomplished during the past year or more. The result in many respects has been very gratifying, resulting in the recovery of specimens representing many species which lived in Jurassic time, and which in perfection are not surpassed, and in fact are not equaled by those obtained by any other institution in existence. The old sand-bars here uncovered are almost as rich in animal remains as are the pitch-beds at Rancho la Brea. The creatures are of course wholly different, representing the Age of Reptiles rather than the Age of Mammals and Birds.

---

It is with sorrow that we record the death, on April 24, of Mr. William H. Reed, the Curator of the Museum of the University of Wyoming. Mr. Reed was born on June 9, 1848, near Hartford, Connecticut. In his early boyhood the family removed to Michigan, and later to Nebraska. In his early manhood, he resided for a time in Ohio, and in the year 1880 married Miss Anna Clark of Milford Center in that state. Later he returned to Wyoming, and becoming acquainted with Professor Othniel C. Marsh, of Yale University, who was engaged in investigating the Jurassic deposits near Como Bluff on the line of the Union Pacific Railway, was taken into the employment of Professor Marsh, and continued to serve him for several years. He became deeply interested, and secured for Professor Marsh a great deal of valuable material. He was very successful as a prospector and collector in the field. Subsequently he became associated with the late Professor Wilbur C. Knight of the University of Wyoming, under whom he worked as a preparator in paleontology.



In the spring of the year 1899 he entered into the employment of the Carnegie Museum as a field assistant under the Director. He was a member of the party led by Dr. Jacob L. Wortman which discovered the specimen of *Diplodocus carnegiei* near Sheep Creek in Albany County, Wyoming. In fact, that discovery was due to Mr. Reed. The Fourth of July was being celebrated in camp as a holiday, and Mr. Reed, shouldering his rifle, went out to hunt, and on his rambles discovered the deposit which yielded up the skeleton of that now famous specimen. The winter of 1899 was spent by him at the Carnegie Museum in the paleontological laboratory. In the spring he resumed work in the field under the late Professor J. B. Hatcher. In the summer of 1900 he voluntarily left the employment of the Carnegie Museum and engaged in copper mining. Later he resumed his connection with the University of Wyoming as Curator of the Museum of the University and as preparator of fossils.

Mr. Reed, although he had enjoyed but few advantages in early life, by reading and contact with men had acquired considerable familiarity with the subject of paleontology, and as a collector proved himself efficient. It was often said of him that he "had a nose for fossils," and found them where others passed them by unobserved.

The news of his death awakens a flood of memories in the minds of his friends at the Carnegie Institute, who trekked with him over the mesas and explored the canyons of eastern and south central Wyoming in the years 1899 and 1900. His good humor, his inexhaustible fund of amusing anecdotes and stories of life on the plains in the days of the early settlement, told in his own inimitable way, remain firmly fixed in the memories of those who enjoyed his companionship.

To his widow and children the Director on behalf of his former associates desires in these lines to express heartfelt sympathy in view of their sad bereavement.

---

ONE of the very interesting discoveries made by Mr. Douglass in the Carnegie quarry in Utah is that of a perfect skull of a *Diplodocus* directly articulated with the atlas, which is followed by the remaining vertebræ of the neck. This beautiful specimen settles for all time the question as to the type of skull which belonged to *Diplodocus*. It is profoundly to be wished that as definite information could be secured as to the heads of some of the other genera of sauropod dino-

saur. As the Director pointed out in his paper read before the Paleontological Society on December 31, 1914, there is no positive certainty as to the head which belonged to *Apatosaurus*. No specimen has as yet been found with the skull so situated in relation to the cervical vertebræ as to remove the question from the field of controversy. The association made by Professor Marsh, which has generally been accepted by those who have not had opportunities to closely study the subject, appears to have been in the nature of a guess. There is a good deal of reason to think that Professor Marsh may have been in error.

---

MR. AND MRS. OTTO E. JENNINGS have returned from the State of Washington where they spent the summer making botanical collections for the Museum. They were highly successful and the result has been the acquisition by the herbarium of many thousands of specimens representing in the neighborhood of fifteen hundred species of the flowering plants of that State. Collections were made by Mr. Jennings on the high mountains, in the arid interior, and along the coast. Incidentally Mrs. Jennings succeeded in collecting quite a number of insects, some of which are entirely new to our collections.

---

DR. ARNOLD E. ORTMANN has twice visited the drainage basin of the Tennessee, and has made very large collections both in its upper affluents and in the broader reaches of the river below Knoxville. He reports that this Museum now possesses as the result of his researches the largest and most perfect collection of the mollusca and crustacea of eastern Tennessee in existence in any museum. His studies, based upon these extensive collections, will enable him to clear up a number of disputed questions as to synonymy and will pave the way for the preparation of a monograph similar to that upon the molluscan fauna of the Ohio River which is in course of preparation.

---

WE have acquired by purchase from Mr. Samuel M. Klages a very large collection of the birds of Venezuela, which adds a multitude of species of South American forms to our collection. From the same source we have also secured a considerable collection of the lepidoptera of the same country.



WE have purchased a collection of the lepidoptera of Arizona made by Mr. O. C. Poling during the past summer, which will add a number of species to the collection which heretofore have not been represented.

---

WE are indebted to Mr. Herbert DuPuy for the gift to the Museum of a model of a Pullman parlor car. It is one of two models, in the fabrication of which it is stated that two thousand dollars' worth of gold and silver was employed. The model is about three feet long. It will be provided with small electric lights which will enable the interior as well as the exterior, to be thoroughly inspected. Every minute detail is reproduced in miniature, even to the cuspidors on the floor.

---

DR. L. E. GRIFFIN has been working diligently during the summer of 1915 in arranging the collections of recent reptiles in the Museum, and reports that he is now in a position to begin the preparation of a catalog, which will include, when published, descriptions of a number of species new to science.

---

MUCH industry has been displayed by Dr. Eigenmann, the Curator of Ichthyology, during the past summer. He has partly re-arranged the collections and has studied and described a number of species new to science. He was assisted by Mr. Arthur W. Henn, who has now left us in order to take up a course of postgraduate study at Columbia University, where he is reading for the degree of Doctor of Philosophy. One of the results of Mr. Henn's work during the summer has been the preparation of a highly interesting and important paper upon the Pœciliidæ, which the Director takes pleasure in issuing in the present number of the ANNALS. A large and important paper by Dr. Eigenmann upon the Cheirodontinæ will shortly appear as Part I of Vol. VII of the Memoirs. It is in the hands of the printer.

---

ARRANGEMENTS have been concluded for the purchase from Mr. Alan W. Owston of Yokohama of his entire collection of the fishes of Japan,

known to be the largest and most complete collection of fishes from Japanese waters in private hands. The acquisition of this assemblage of specimens taken in conjunction with collections previously obtained from Japan, Korea, and Formosa, places the Carnegie Museum in the position of having probably the most complete collection of the fishes of those regions in America.





## I. DESCRIPTION OF A NEW SPECIES OF TORTOISE FROM THE JURASSIC OF UTAH.

BY CHARLES W. GILMORE.

(PLATES I-II.)

By the kindness of Dr. W. J. Holland, Director of the Carnegie Museum, I am permitted to study and describe the large series of fossil chelonian remains, which that museum has accumulated during the years since 1906, before which time the collections in Pittsburgh were subjected to study by Dr. O. P. Hay. It is proposed to treat these collections in a series of articles, each to be devoted to the turtles of a particular formation. The turtles from the Morrison beds are the basis of the present communication. Being the most ancient of any found in North America, they are of peculiar interest.

There are three specimens in the collection, all from the extensive quarry near Jensen, Uinta County, Utah, from which the Carnegie Museum has obtained a wonderful collection of the remains of sauropodous dinosaurs. One of these specimens, Cat. No. 3411, pertains to the well-known genus and species *Glyptops plicatulus* (Cope), and is only of interest as greatly extending the known geographical range of this species. The remaining specimens I regard as representing a new species of *Glyptops* to be described in the following pages. The better preserved specimen, Cat. No. 3380, although differing in several features from the type, is for the present at least referred to the same species.

### ***Glyptops utahensis* sp. nov.**

**Type:** Cat. No. 3412, complete carapace and plastron; **Paratype:** Cat. No. 3380; both specimens collected by Earl Douglass, 1913, at Carnegie Dinosaur Quarry, near Jensen, Uinta County, Utah.

**Horizon:** Morrison, Upper Jurassic.

The carapace of the type, when compared with *Glyptops plicatulus* (Cope), is relatively long and narrow, with a depressed shell, having its greatest depth of 63 mm. at the center. Transversely the carapace is evenly convex, but antero-posteriorly the front portion is but little below the level of the back, whereas the posterior portion descends

from the center to the posterior border on a long gradual slope. The outline of the anterior border of the left side is somewhat distorted from the healing of an old wound. (See Pl. I, fig. 1.) Most of the sutures can be clearly traced, but the sulci marking the limits of the epidermal scutes, except on the ventral areas, cannot be determined in either specimen, and as to the extent of the dorsal scutes we must await the discovery of additional material.

The carapace is 252 mm. long on the midline, and 178 mm. wide. Compared with a specimen of *Glyptops plicatulus* in the U. S. National Museum (Cat. No. 5458) the shell is more depressed and more elongate-oval in its general contour. Anteriorly the border is excavated on the midline and posteriorly it is evenly rounded with a narrow but well-defined median notch. As in *Glyptops plicatulus*, there are eleven peripherals, which extend outward nearly horizontally. Relatively they are thin throughout the series, high on front and back, but narrow above the bridges. The first and second have a height of 25 mm., the fifth of 16 mm.; the ninth of 29 mm.; the eleventh of 26 mm. Their borders are thin and acute in front and behind, but thicken and become somewhat obtuse toward and above the bridges. Along the sides and toward the front on the upper surfaces the peripherals curve upward, thus forming a well defined gutter (best shown in specimen No. 3380, Pl. II, Fig. 1), which becomes wider and shallower especially toward the posterior ends. The deepest part of this gutter is in the center of the peripherals, whereas in *G. plicatulus* it is confined to the outer half of their superior surfaces.

The surface of the carapace is covered with small, rather obscure, but irregularly placed tubercles and ridges, the latter on the median part of the back having a tendency to run in a fore-and-aft direction, but not forming a regular pattern. The sculpture of the carapace would at once distinguish the species from *G. plicatulus* which as Hay<sup>1</sup> says, "is finely sculptured with tubercles and winding ridges, there being about thirteen ridges in a line 10 mm. long." The surface of the plastron and the lower surfaces of the peripherals and bridges in the type of *G. utahensis* are smooth and without sculpture, which would serve to further distinguish it from *G. plicatulus*, which is sculptured beneath. In the second specimen, Cat. No. 3380, there is a decided longitudinal depression or sulcus along the carapace where the second,

<sup>1</sup> Fossil Turtles of North America, Pub. Carnegie Inst., Washington, 1908, p. 49.



third, fourth, and fifth costals join the peripherals, the inner edges of the latter being raised and rounded over. This feature is not apparent on the undamaged side of the type, where the surface of the costals continue smoothly into those of the peripherals.

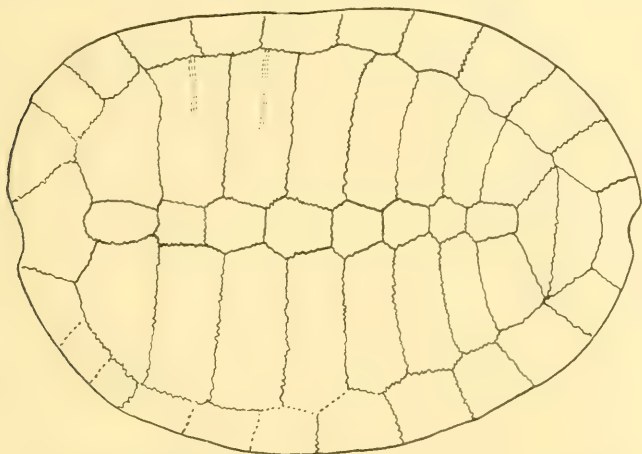


FIG. 1. *Glyptops utahensis*. Carapace of type, No. 3412. One-third natural size.

The nuchal bone is quadrilateral, with the widest side posterior. This side measures 48 mm. in length. The neurals are hexagonal, with the widest end anterior, just as in *G. plicatulus*, except the eighth neural, which is much longer than in any known specimen of that species. The accompanying table presents the dimensions of the neurals as compared with those of *G. plicatulus*, as given by Hay in the publication cited above.

DIMENSIONS OF NEURALS.

No.	<i>G. utahensis.</i>		<i>G. plicatulus.</i>	
	Length.	Width.	Length.	Width.
1	30	17	38	23
2	18 <sup>e</sup>	16 <sup>e</sup>	30	26
3	25 <sup>e</sup>	21	32	24
4	25 <sup>e</sup>	24	26	23
5	19	20	27	23
6	19	19	19	19
7	15	16	18	20
8	23	16	18	21

<sup>e</sup> = estimated.

The pygal measures 40 mm. transversely and 16 mm. antero-posteriorly; at the median notch it is only 10 mm. fore-and-aft. As in *G. plicatulus* there are two suprapygals.<sup>1</sup> The form of these bones is well shown in Fig. 1. The greatest width of each is 53 mm.; the antero-posterior diameter of the posterior element at the midline is 18 mm.; the same measurement of the anterior element is 14 mm.

The costal plates narrow in succession from before backward, the eighth being relatively wider than in *G. plicatulus*.

The plastron is comparatively narrow. It is thin and flat, except on the hinder two-thirds of the posterior lobe, which is shallowly concave transversely. It has a length of 224 mm., and extends slightly in advance of the border of the carapace. The anterior lobe is 68 mm. long, its width at the base being 87 mm. The borders are relatively thin and rounded.

The entoplastron measures 55 mm. in length, and 55 mm. in width. It is more pointed behind than in *G. plicatulus*, resembling in this respect the entoplastron of *G. depressus* Hay.

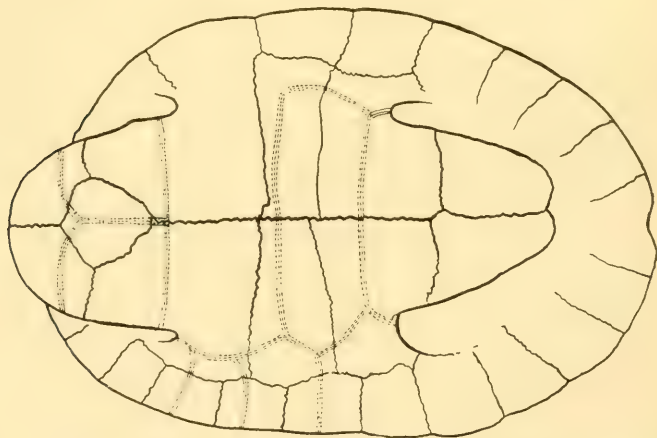


FIG. 2. *Glyptops utahensis*. Plastron of type, No. 3412. One-third natural size.

The mesoplastra differ in width at the midline, the right being 20 mm.; the left 23 mm. The hypoplastrals meet on the midline for about 46 mm. The xiphiplastral bones have their greatest length, 45 mm., at their median junction.

<sup>1</sup> Hay, O. P., Proc. U. S. Nat. Museum, Vol. 35, 1908, p. 162, Fig. 1.

The posterior lobe diminishes rapidly in width, backward from the hypo-xiphiplastral suture, much as in *Probaëna sculpta* Hay. Its posterior extremity is truncated, ending 38 mm. anterior to the hinder margin of the carapace. The free borders of the hinder lobe are acutely edged, the bones being but little thickened back from the margin. The bridge is 87 mm. wide. The sulci of the plastron can only be made out in part as shown in Fig. 2. The gular scutes are broad, the sulci bounding them (See Fig. 2) curving outward and slightly backward, much as in *G. plicatulus*, but not approaching the epi-hyoplastral sutures so closely as in the latter species. The inter-gulars cannot be differentiated. The gular-humeral sulcus cuts across the antero-median part of the entoplastron. The humero-pectoral sulcus passes almost straight across and behind the entoplastron. Inframarginal scutes are present on the bridge, but their full outlines, or exact number, cannot be determined from the present specimens. They appear to lie almost entirely on the plastral bones.

The present species is distinguished from *Glyptops plicatulus* (Cope), described from the same geological horizon, by the following differences:

- (1) Elongated-oval contour of the carapace and its relatively narrow transverse diameter.
- (2) Difference in the pattern of the ornamentation of the carapace and sculptureless plastron.
- (3) Posterior lobe of plastron relatively narrow.
- (4) The greater width of the gutter on the peripherals.
- (5) Deeper median anterior emargination, with a narrow notch on the median posterior border of the carapace.
- (6) The greater length of the eighth neural.

From *Glyptops calatus* Hay the present species is distinguished at once by the coarser and more regular ornamentation of the carapace in the former. From *G. pervicax*, the relatively longer and narrower anterior lobe of the present species is a distinguishing character. From *G. depressus* Hay the species is differentiated by the narrower nuchal and neural bones, by the regular decrease in width of the costals from front to back, and the relatively narrower mesoplastrals.

Specimen No. 3380 from the same geological level and from the same locality, although showing some differences, such as a longitudinal sulcus, or groove, at the junction of the second, third, fourth, and fifth costals with the peripherals, different contour of the entoplastron, and



a slight transverse convexity of the bridges (in the type they are somewhat concave) on account of its close resemblance in form and other features is referred to the present species. Its close resemblance to the type is clearly shown by a comparison of Plates I and II.

## EXPLANATION OF PLATE I.

FIG. 1. Carapace of *Glyptops utahensis*. Type, No. 3412, Carnegie Museum  
Cat. Foss. Vert.  $\times \frac{44}{100}$ .

FIG. 2. Plastron of the same.  $\times \frac{44}{100}$ .

## EXPLANATION OF PLATE II.

FIG. 1. Carapace of *Glyptops utahensis*. Paratype, No. 3380, Carnegie Museum  
Cat. Foss. Vert.  $\times \frac{40}{100}$ .

FIG. 2. Plastron of the same.  $\times \frac{40}{100}$ .

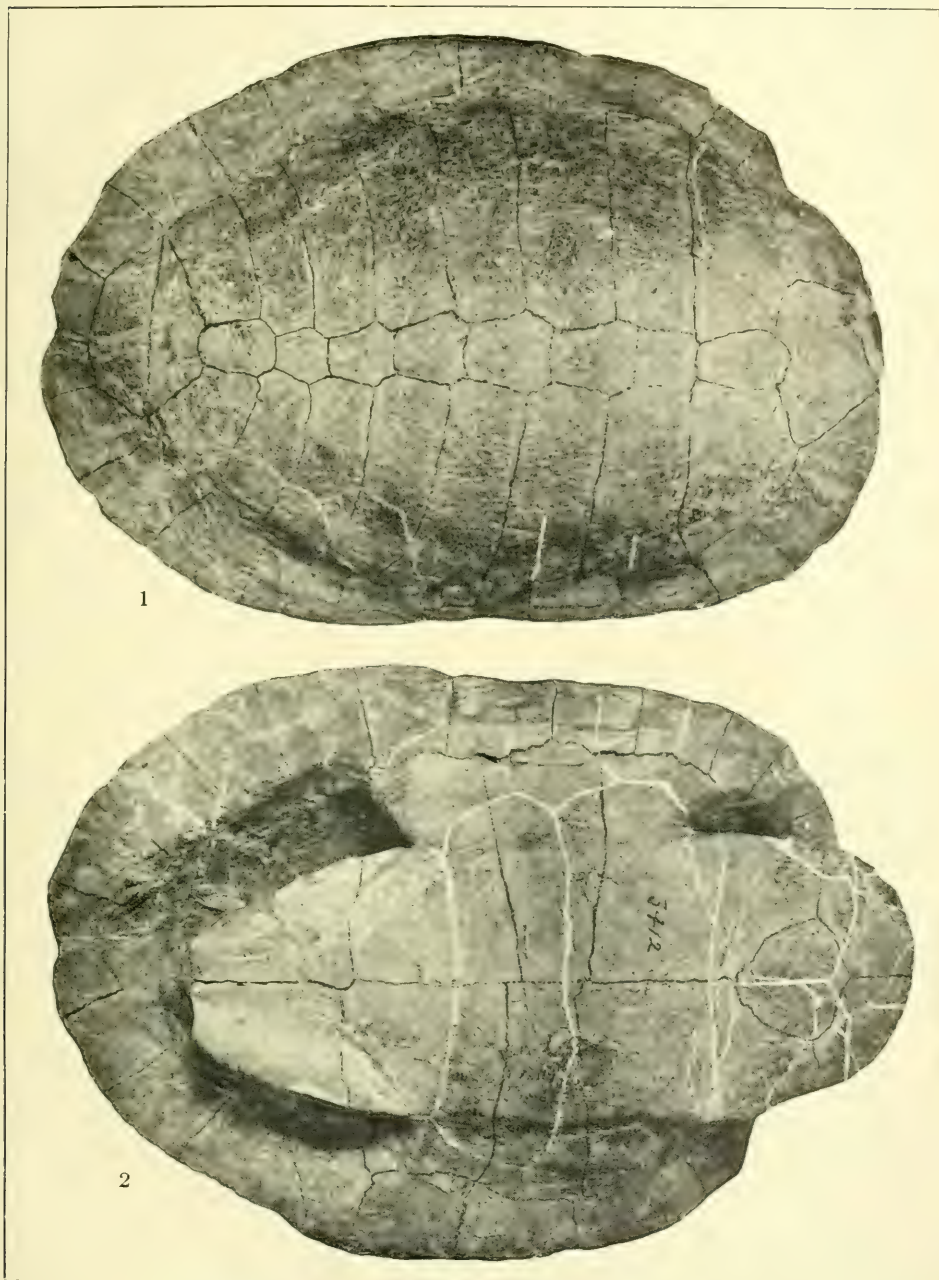


FIG. 1. Carapace of *Glyptops utahensis* Gilmore. Type. No. 3412, Cat. Vert. Foss. C. M.

FIG. 2. Plastron of *Glyptops utahensis* Gilmore. No. 3412, C. M. Both figures about  $\frac{44}{100}$  nat. size.







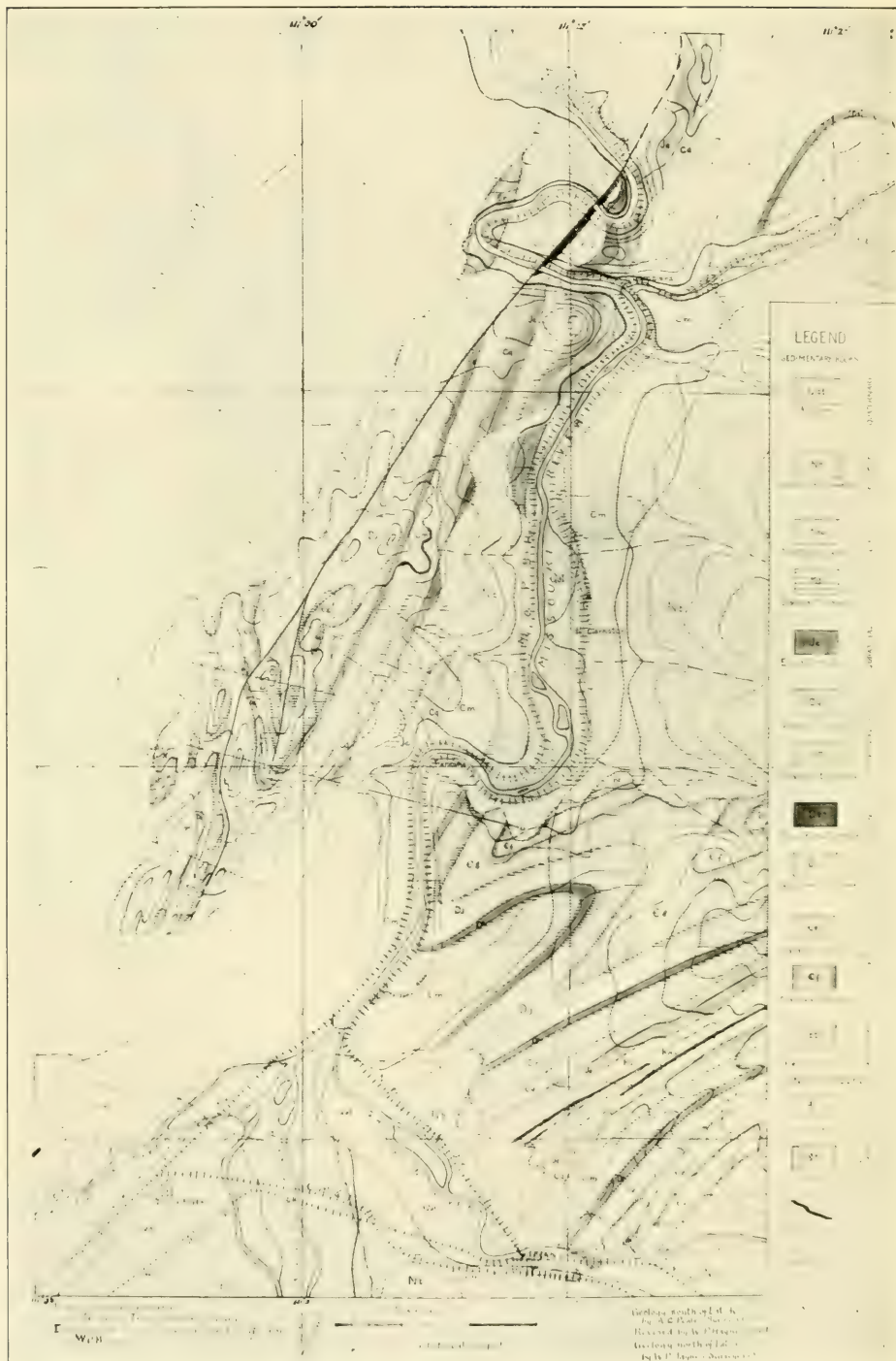
FIG. 1. Carapace of *Glyptops utahensis* Gilmore. Paratype, No. 3380, Cat. Vert. Foss., Carnegie Museum.

FIG. 2. Plastron of *Glyptops utahensis* Gilmore. No. 3380, C. M. Both figures about  $\frac{40}{100}$  nat. size.









Geologic Map of Region about Three Forks, Montana.

## II. THE FAUNA OF THE UPPER DEVONIAN IN MONTANA.

### PART 2. THE STRATIGRAPHY AND THE BRACHIOPODA.

BY W. P. HAYNES.

(PLATES III-VIII.)

A number of years ago Dr. P. E. Raymond undertook the description of the fauna of the Upper Devonian in Montana, basing his work upon collections made by Mr. Earl Douglass and himself for the Carnegie Museum. The first part, containing a description of the Cephalopoda and a few other fossils from the "Red shales," appeared in 1909 in these ANNALS.

In this, the second contribution to the subject, the writer describes the Brachiopoda, based on the material in the Carnegie Museum, supplemented by collections, which he has himself made for the Museum of Comparative Zoölogy, and describes the stratigraphy of the formation.

The writer is indebted to Dr. Raymond for many suggestions in the preparation of this work for publication.

#### STRATIGRAPHY.

The writer has made a study of the Three Forks Formation at its type-locality at Three Forks, Montana, and also throughout the Three Forks quadrangle and the neighboring region along the Missouri river in the Fort Logan quadrangle (See Plate III). In this report the distribution and stratigraphy of the formation will first be considered, and then the fauna will be discussed, with a detailed description of the brachiopods of the limestone and green shale members of the formation.

#### *Three Forks Formation.*

*General Description.*—Lying in apparent conformity upon the Jefferson limestone is a series of shales and limestones, which have been named by the late Dr. A. C. Peale the Three Forks Shales.<sup>1</sup> He described the formation in some detail, which may be briefly summarized by the following columnar section.

<sup>1</sup> Peale, A. C., Bull. U. S. G. S., No. 110, pp. 29-30, 1893.

	Yellow laminated sandstones. ....	25 ± feet.
Upper Shales	Greenish gray nodular limestones, Dark colored argillaceous limestones, Soft shaly black and purplish calcareous limestones..	45 feet.
	Fine green argillaceous shale. ....	30 "
Intermediate Limestone	Compact grayish brown limestone, weathers into orange debris and obscures lower shales. ....	15-20 feet.
Lower Shales	Reddish and brownish yellow argillaceous shales ....	$\frac{50}{145}$ "
		145 ± feet.

Dr. Peale noted the absence of fossils in the Lower Shales and the overlying limestone, and the great abundance of fossils of Devonian age in the Upper Shales, particularly in the calcareous portions. He also noted the presence of a band of black slate or shale in the section at the base of the Yellow Sandstone member at two localities, one near the Horseshoe Bend of the Missouri River near Rekap, and the other south of the Jefferson River near Antelope Creek.

The writer has visited both of these localities and has included sections measured at both places among the lists of sections given in the following pages.

Dr. Peale in summarizing his description of the Three Forks Shales noted the fact that they become more arenaceous to the east of Three Forks, as they pass into the Bridger Range, while they become more calcareous to the west on the north side of the Jefferson River.

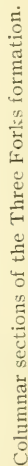
This description given by Dr. Peale applies to the Three Forks Formation as seen in the northern part of the Three Forks quadrangle, but in the southern part the formation has changed and becomes more dominantly a limestone with argillaceous and arenaceous phases. Owing to the fact that the strata called the Three Forks Shales by Dr. Peale are a composite series and include limestones and shales and some sandstones, the writer feels that it is advisable to use the name "Three Forks Formation" which is applicable to the southern occurrences as well as to those about Three Forks.

The writer has found it possible to divide the Three Forks Formation into seven members, which are easily recognized by their lithologic characters and are present in all of the sections studied in the northern part of the quadrangle and the adjacent region to the north. This sevenfold division will be noted in the case of each section, so that a





COLUMNAR SECTIONS OF THE THREE FORKS FORMATION.



comparison of the thickness of any of the members in different parts of the region can easily be made by referring to the numbers. It is noticeable that in all of these sections the thickness of the formation is considerably greater than in the section given by Dr. Peale, which has been generally taken as the standard for the Three Forks Formation.

For purposes of general comparative study the five columnar sections on Plate IV have been drawn. These sections are arranged in order from left to right, from the northeastern part of the region to the southwestern.

Throughout all of the region where the Three Forks Formation has been recognized it is almost invariably exposed in a small valley. This is due to the fact that it is prevailingly a shaly formation occurring between two massively bedded limestone formations, and differential erosion has produced the characteristic valley between the Jefferson and Madison limestone ridges. Because the formation generally occurs in a valley the exposures are obscured and the contacts masked by talus and vegetation. Often the valleys were traversed by the writer for several miles without finding any place where a satisfactory section could be measured. In consequence of this many of the sections are incomplete, especially in the lower part, but since no fossils have been found in the two lower members it is not so important that they should be included in the sections. The figures which are given were obtained by measurements with a steel-wire tape and the thicknesses were either measured directly or computed from the horizontal distance and the angle of dip.

The details of the various sections of the Three Forks Formation studied by the writer will now be considered in order from north to south.

*Section A.*—The most northerly occurrence of the formation was observed about four miles east of Lombard and one and one-half miles northeast of Crane, a flag station on the Chicago, Milwaukee, and Puget Sound Railway. Here there is a good exposure in a saddle, back of a cliff of the massive brown Jefferson limestone. The strata have a strike of about N.  $70^{\circ}$  E. and dip  $15^{\circ}$  north. The Lower shale member is almost entirely obscured by vegetation and only a small amount of reddish yellow angular shaly fragments in some gullies indicates its presence. The intermediate limestone member is of a rather bright yellow color and contains some white calcite veins. Above the limestone, which is about fifteen feet thick, there is a good

exposure of the very fissile green shale member. The green shale is from sixty to seventy feet thick and contains numerous bands of greenish and grayish limestone concretions, which are usually very fossiliferous. From many horizons in the lower forty feet of the green shale, pyritized fossils, chiefly cephalopods, often beautifully preserved, weather out on the surface and furnish excellent collecting. Above the green shale at this locality is about ten feet of very fossiliferous gray limestone which weathers reddish on the surface. Overlying this limestone are thirty or forty feet of yellowish shales, grading upward into calcareous sandstones. Above the yellow sandstones is the gray Madison limestone with fossils of Mississippian age. This section northeast of Crane was not measured carefully with a tape, because many of the contacts were obscured by talus or vegetation. However, enough of the section was exposed to show that it closely resembles the sections to the south at Rekap and Logan.

*Section B.*—The section next south of Lombard is near Rekap Station on the Northern Pacific Railway. The strata here strike N. 30°–35° E. and dip 30° W. The section was measured from the base of the gray Madison to the top of the brown Jefferson limestone and includes the following seven members:

1 and 2. Yellow sandy limestone and shale.....	74 feet.	
3. Black coaly shale.....	6 "	
4. Nodular gray limestone.....	7 "	
5. Fissile green shale	} .....	120 "
and		
6. Gray and orange limestone.....	} .....	80 "
7. Pebbly yellow and reddish limestones and shales.....		
Total.....		287 feet.

The Three Forks formation was measured at two localities near Logan, Montana. One section was near the Gallatin River and the other was about two miles inland. The strata here strike about N. 50° E. and dip 40°–50° W.

*Section C,* measured near the Gallatin River, is as follows:

Base of gray Madison limestone.		
1. Yellow arenaceous limestone.....	30	feet.
2. Pale yellow arenaceous shale.....	30	"
3. Purple fissile shale.....	.5	"
4. Bluish gray nodular limestone.....	9.5	"
5. Fissile green shale.....	47	"
6. Yellow crystalline limestone with calcite veins.....	15	"
Massive grayish brown limestone.....	12	"
7. Yellow and orange blocky shales.....	78	"
Total.....		222 feet.



*Section D*, measured two miles farther north is as follows:

Base of gray Madison limestone.

1. Yellow sandstone with some shale.....	44	feet.
2. Yellow shaly limestone.....	15	"
2a. Yellow argillaceous shale.....	5.5	"
3. Purplish red shale.....	1	"
4. Nodular gray limestone.....	8	"
5. Green shale.....	49	"
6. Orange limestone and	}	130 "
7. Reddish yellow shales mostly obscured		

Top of Jefferson limestone.

Total..... 252.5 feet.

The region north of Three Forks and west of the Missouri River has many good exposures of the Three Forks Formation. The valleys eroded in the formation have a general north to south direction and are nearly parallel with one another. The repetition of the formation is due partly to folding and partly to faulting. The structure in the central part of the ridge is that of a southward pitching anticlinal fold which is overturned to the east. A very large valley is eroded in the Three Forks formation in the western limb of the fold. The strata here strike N. 10° E. and dip 30° W. The following section was measured on the western side of this valley across the upper part of Three Forks Formation.

*Section E:*

Base of gray Madison limestone.

1 and 2. Yellow sandstone and shale.....	75	feet.
3 and 4. Purplish shale with limestone at the base.....	20	"
5. Fissile green shale with layers of limestone concretions.		
Lower part of section obscured.		

West of the overthrust fault there is another valley formed in the Three Forks Formation. The strata here strike N. 20°-30° E. and dip 30°-40° W. The best exposures were seen on the western side of the valley in the small tributary gullies which cut across the dip of the strata. Partial sections were measured along this valley at several places in a distance of over two miles. These sections, beginning at the northern end of the valley, are as follows:

*Section F*, on tributary gully 3, western side of valley.

Base of yellow shale No. 2.

3. Purplish black shale weathering reddish.....	13.5	feet.
4. Gray limestone.....	5	"
Top of green shale No. 5.		

*Section G*, on tributary gully 4, western side of valley.

Base of gray Madison limestone.

1. Yellow sandy limestone.....	44 feet.
2. Finely laminated pale yellow arenaceous shale, lower five feet drab colored and argillaceous.....	28 "
3. Fissile purplish black shale.....	19 "
4. Gray limestone.....	8 "
5a. Finely laminated green shales.....	75 "
5b. Yellowish and purplish white shale.....	45 "
6. Yellow limestone with calcite veins.....	15 "
7. Reddish yellow shales.....	45 "
Total.....	279 feet.

*Section H*, between tributary gullies 4 and 5 on the western side of the valley.

Base of yellow shale No. 2.

3. Purplish black coaly shale.....	15.3 feet.
Top of limestone No. 4.	

*Section I*, on fifth gully on western side of valley.

Base of gray Madison limestone.

1. Yellow sandy limestone,	}	93 feet.
2. Yellow shales,		
3. Purplish shales,		
4. Gray limestone,		
5. Green finely laminated shales.....		77 feet.
5a. Purple and yellow soft argillaceous shales.....		51 "
6. Yellow limestone with calcite veins.		

Lower part of section obscured.

*Section J*, at the southern end of this western Three Forks valley. Here the strata have a strike of about N. 40° E. and a dip of 20° W.

Base of gray Madison limestone.

1. Yellow sandstone.....	17 feet.
2. Laminated yellow shale.....	10 "
2a. Yellowish white limestone.....	2.5 "
3. Purplish gray shale.....	5 "
4. Gray nodular limestone.....	3 "
5. Fissile green shales.....	54 "
5a. Whitish yellow argillaceous shales.....	14 "
(Dr. Raymond's white blocky shale?)	
5b. Finely laminated yellowish green and locally reddish shale	7 "
(Dr. Raymond's red shale?)	

Top of Orange limestone No. 6.

The following sections of the Three Forks Formation were measured by the writer south of Jefferson River between Willow and Antelope Creeks.

*Section K*, measured one and one-half miles west of Willow Creek. Here the strata are vertical and have an east-west strike.

Base of gray Madison limestone.	
1 and 2. Yellow sandstone and shales.....	70 feet.
3. Black coaly shale.....	5 "
4 and 5. Green shale calcareous at the top, with white and yellowish shales at the base.....	87 "
6. Massive gray limestone.....	41 "
7. Yellow nodular limestone.....	53 "
Total .....	256 feet.

Top of brown Jefferson limestone.

*Section L*, farther west in Three Forks ravine. Strike of strata N. 80° W. dip 70° N.

Base of gray Madison limestone.	
1. Yellow sandstone and talus obscuring 2, 3, 4, 5.....	108 feet.
6. Gray massive limestone.....	15 "
7. Yellowish red thinly bedded limestone.....	25 "
7a. Nodular red limestone, nodules 2 to 3 inches in diameter ..	73 "
Total .....	221 feet.

*Section M* was measured just east of Sand Creek. The strata strike N. 60° E. and dip 40° N.

Base of gray Madison limestone.	
1. Yellow sandstone in cliff.....	10 feet.
2, 3, 4, and 5. Contacts obscured and therefore not measured separately .....	135 "
5a. Thinly bedded white and yellowish limestone.....	18 "
5b. Pale pink shaly limestone.....	12 "
Top of grayish yellow limestone No. 6.	

*Section N*, measured about a half miles west of Sand Creek.

Base of gray Madison limestone.	
1 and 2. Yellow arenaceous limestone and nodular yellowish gray limestone.....	76 feet.
3. Black coaly shale.....	5 "
4. Gray nodular limestone.	
Remainder of section obscured.	

*Section O*, the westernmost section, was measured about a quarter of a mile east of Antelope Creek. Strike E.-W., dip 30° N.

Base of gray Madison limestone.

1 and 2. Yellow sandy limestone and shale. ....	79 feet.
3. Black coaly shale. ....	7 "
4. Gray nodular limestone. ....	8 "
5. Green fissile shale. ....	43 "
5a. White thinly bedded limestone partly stained with limonite	20 "
5b. Purplish white thinly bedded limestone.	
Remainder of section obscured.	

This completes the list of measured sections of the Three Forks Formation in the northern part of the quadrangle and the neighboring region to the north. A comparison of these sections shows the persistence of all of seven members in all parts of the region. The members show in the different sections a considerable variation which may be briefly summarized as follows:

Members 1 and 2 together vary from 60–80 feet and have an average thickness of about 70 feet. Member 3 varies in thickness from about 19 feet, in the west Three Forks valley, to 6 inches at Logan. It has an average thickness of about 6 feet. Member 4 varies from 3 to 10 feet in thickness; member 5 from 50 to 120 feet; member 6 from 15 to 40 feet, and member 7 varies from 40 to 80 feet.

These thicknesses of members 1 and 6 are much greater than those given by Dr. Peale in his section for the formation. Dr. Peale's figures have apparently been adopted by Dr. Kindle<sup>2</sup> in his section at Logan, Mont., and also by Dr. Raymond,<sup>3</sup> who, although he did not measure the section here or north of Three Forks, noted the presence of (1) a Lower Red-Shale zone; (2) a Green-Shale zone, and (3) a White Blocky Shale, all part of Dr. Peale's Green Shales. The writer has noted in Section J the probable position and thickness of these zones as recognized by Dr. Raymond. Although these zones are indicated in Sections G and I "farther north" and in Sections M and O south of the Jefferson River, they are generally not clearly defined and therefore are not given a place among the seven members of the formation as recognized by the writer.

The slight thickness of the yellow sandstone and shales of members 1 and 2, noted in Section J, is probably partly due to obscured contacts, and somewhat to actual thinning of the strata. Some deformation in the strata due to the folding and overthrusting may also be the cause of the lessened thicknesses of the members in this section.

<sup>2</sup> Kindle, E. M., *Bull. Am. Pal.*, No. 20, p. 8, 1908.

<sup>3</sup> Raymond, P. E. *Amer. Jour. Sci.*, Ser. IV, vol. XXIII, pp. 116–122, 1907.



A comparison of all of the sections shows a distinct increase to the southwest in the amount of limestone in the formation. This is due chiefly to the increase in thickness of member 6 and the predominance of limestone in member 7. Thus there is a gradation toward the conditions which prevail in the southern part of the quadrangle.

Fossils were obtained from the upper part of the formation at all of the localities where sections were measured. The fossiliferous members of the formation are numbers 1, 2, 4, and 5. Fossils are particularly abundant in number 4, the gray limestone, and number 5, the green shale. The fossils in numbers 4 and 5 indicate an Upper Devonian age, and those in 1 and 2 indicate a transition into the Mississippian. The evidence for the age of the formation will be given with the description of the fossils.

The sections of the Three Forks Formation studied by the writer in the southern part of the Three Forks quadrangle are not as satisfactory as those just given on account of the much poorer exposures. The country here is much more mountainous, and the shaly beds are obscured by talus and vegetation. No fossils were obtained from the formation here, but this was probably due to insufficient search and poor exposures, because fossils have been found in small numbers in the formation in the northwest corner of the Yellowstone Park, which adjoins the Three Forks quadrangle on the southeast.

The best section measured by the writer in the southern part of the Three Forks quadrangle is located in the upper end of the West Gallatin Canyon where it opens out into the Lower Basin. Here the strata are downfaulted against the gneiss along a nearly vertical fault plane. The strata strike about N. 40° W., nearly parallel with the fault, and dip about 50° S. The thicknesses of the beds considered to belong to the Three Forks Formation are as follows:

Base of gray Madison limestone.	
Gray shaly limestone weathering buff, in lower part red and yellow.....	
	125 ± feet.
Brown limestone, breaking into small joint blocks.....	25 "
Yellowish red shaly limestone.....	40 "
Grayish brown limestone breccia.....	15 "
Obscured by talus.....	35 "
Total.....	240 ± feet.
Brown Jefferson limestone with <i>Favosites cf. limularis</i> .	

It will be noticed that although the seven members which compose the formation in the northern part of the quadrangle cannot be re-



cognized here there is a general persistence of a lower and upper shaly member separated by a more massive limestone. There are, however, no true argillaceous shales in the formation, as exposed in the southern part of the quadrangle.

Some of the sections of the Three Forks Formation measured by Dr. Weed<sup>4</sup> in the northwest corner of the Yellowstone Park are similar in lithologic character to the section already given. Three of these sections are as follows:

*Crowfoot Ridge Section.*

Buff and red fissile argillaceous and siliceous limestone...	30 feet.
Crystalline magnesian limestone, generally dense and massive.....	50 "
Limestone, impure and argillaceous, in alternating thin fissile, and massive gray beds.....	100 "
Total.....	180 feet.

*Antler Peak Section.*

Light gray limestone, somewhat massive.....	40 feet.
Dark brownish gray arenaceous limestone.....	130 "
Total.....	170 feet.

*Bighorn Pass Section.*

Gray crystalline limestone.....	80 ± feet.
Dark bluish gray massive argillaceous limestone.....	20 "
Alternating beds of massive gray arenaceous limestone and fissile light gray limestone.....	40 "
Total.....	140 ± feet.

East of the Yellowstone Park in the region described in the Absaroka folio of Central Wyoming, Dr. Weed<sup>5</sup> has identified the Three Forks Formation, which there has an average thickness of about 250 feet. He describes the formation as consisting of bluish gray limestone at the base, alternating with shaly beds and fine clays. These pass upward into bedded limestones generally bright purple and blue, with intercalated thin layers of indurated earthy and sandy material. Recurring alternations abound, but limestone is the prevailing rock. In places near the top of the formation the shaly beds exhibit bright red and orange tints. Localities yielding small groupings of a marine Devonian fauna occur at several places in the Absaroka district.

The Three Forks Formation has been recognized by Dr. Kindle<sup>6</sup> in

<sup>4</sup>Weed, W. H., Mono., 32, pt. 2, pp. 7, 22, and 26, 1899.

<sup>5</sup>Weed, W. H., Atlas Folio, U. S. G. S., No. 52, 1899.

<sup>6</sup>Kindle, E. M., *Bull. Am. Pal.*, No. 20, p. 12, 1908.

a section measured by him in southwestern Wyoming, on Labarge Mountain, northeast of the town of Viola. Here he notes the presence of 80 feet of drab shales and shaly, thin-bedded magnesian and siliceous limestone, barren of fossils, occurring below dark gray Madison limestone and above the Jefferson limestone.

The southernmost occurrence of the Three Forks Formation, which the writer has seen recorded, is in a section near Bear Lake in northern Utah in the Randolph quadrangle. Mr. Richardson<sup>7</sup> reports the presence of 200 feet of soft reddish shaly limestone, which is poorly exposed, occurring between the Jefferson and Madison limestones. He considers this the equivalent of the Three Forks Formation farther north.

North of the Yellowstone Park the Three Forks Formation has been recognized in the Livingstone, Little Belt Mts., and Fort Benton Quadrangles. In the Livingstone quadrangle<sup>8</sup> it is described as a series of thinly bedded, impure limestones, alternating with thin beds of shale, with a total thickness of about 250 feet. The top beds are often purple and red in color. The lower strata are earthy shales in beds a few feet thick, alternating with limestone layers of equal thickness.

In the Little Belt Mountains Quadrangle<sup>9</sup> the upper member of the Monarch formation is equivalent to the Three Forks formation of other quadrangles. It consists of thinly bedded shaly limestones (with much argillaceous matter), of a bluish gray color when fresh, but weathering to a straw-yellow or pink color. The thickness is usually 40 or 50 feet and does not exceed 140 feet.

In the Fort Benton quadrangle<sup>10</sup> the upper 30 feet of the Monarch Formation is equivalent to the Three Forks Formation, and consists of reddish shaly limestone with abundant Devonian fossils. This is as far north as the Three Forks Formation has been recognized so far as the writer can ascertain.

Northwest of Three Forks the Formation has been recognized in the Helena District by Dr. Knopf<sup>11</sup> who describes the section as follows:

Fine-grained black carbonaceous shales.....	15 feet.
Light-colored fossiliferous calcareous shales, grading downward into earthy shales with interbedded quartzite.....	270 feet.
Total.....	285 feet.

<sup>7</sup> Richardson, G. B., *Amer. Jour. Sci.*, Ser. IV, Vol. XXXVI, pp. 406-416, 1913.

<sup>8</sup> Atlas Folio, U. S. G. S., No. 1.

<sup>9</sup> Atlas Folio, U. S. G. S., No. 56.

<sup>10</sup> Atlas Folio, U. S. G. S., No. 55.

<sup>11</sup> Knopf, A, Bull. U. S. G. S., No. 527, p. 92, 1914.

Another section is as follows:

Black shale.....	56 feet.
Calcareous argillite.....	136 "
Shale.....	40 "
Total.....	232 feet.

Farther west, in the Philipsburg Quadrangle,<sup>12</sup> the Three Forks Formation is apparently absent, and the Jefferson limestone is immediately overlain by the Madison limestone. In the Camp Creek section near Melrose, about 50 miles southwest of Three Forks, Dr. Kindle<sup>13</sup> maintains that the Three Forks Formation is represented by a bluish gray argillaceous shale and buffish shale in the lower part, with limestone bands near the middle, having a total thickness of about 200 feet.

The boundaries of the region throughout which the Three Forks Formation has been recognized may tentatively be placed at latitudes 48° and 42° north and longitudes 109° and 113° west. This includes a region with a north-south dimension of about 400 miles and an east-west dimension of 200 miles. It is very evident from these figures that the Three Forks Formation has not nearly so widespread a distribution as the Jefferson limestone, which underlies it, or the Madison limestone, which overlies it.

Although the Three Forks Formation has not been recognized by its lithological characters outside of the region just noted, it is likely from faunal evidence that the sea, in which the Three Forks Formation was deposited, covered an area much greater than that in which the formation has been recognized. The similarity of some of the fauna of the lower part of the Ouray limestone of Colorado with the brachiopod fauna of the Three Forks Formation indicates a connection in that direction, and the presence of a small Ouray faunule from the beds transitional from the Lower Banff limestone to the Lower Banff shale, reported by Dr. Shimer<sup>14</sup> in the Lake Minnewanka section in Alberta indicates a spreading of this Upper Devonian sea to the north.

#### THE FAUNA OF THE THREE FORKS FORMATION.

The writer has made a careful study of the collection of fossils made by Dr. Raymond for the Carnegie Museum and also of his own col-

<sup>12</sup> Calkins, F. C., Prof. Pap. U. S. G. S., No. 78, p. 65, 1913.

<sup>13</sup> Kindle, E. M., *Bull. Amer. Pal.*, No. 20, p. 9, 1908.

<sup>14</sup> Shimer, H. W., *Bull. Geol. Soc. Am.*, Vol. XXIV, pp. 233-240, 1913.



## FAUNAL LIST OF THE THREE FORKS FORMATION.

	5			4	2	1
	L.	M.	U.			
<b>BRACHIOPODA.</b>						
<b>Atremata.</b>						
<i>Lingula hubbardi</i> sp. nov. ....		R	R			
<i>L. alba-pinensis?</i> Walcott. ....	R					
<i>L. cf. læna</i> Hall. ....	R					
<i>L. sp. nov.?</i> ....	r					
<b>Neotremata.</b>						
<i>Orbiculoidea lodiensis</i> (Vanuxem) ....		R				
<i>Orbiculoidea</i> sp.? ....		R				
<b>Telotremata.</b>						
<i>Spirifer raymondi</i> sp. nov. ....	r	c	c	r		
<i>S. whitneyi</i> Hall. ....		r	r	r		
<i>S. whitneyi</i> var. <i>monticola</i> var. nov. ....	r	C	C	C		
<i>S. whitneyi</i> var. <i>animasensis</i> (Girty)....		r	r	r		
<i>S. whitneyi</i> var. <i>gallatinensis</i> var. nov. ....		r	r	r		
<i>S. cf. cuspidatus</i> Meek. ....						c
<i>S. cf. newberryi</i> Hall. ....						c
<i>S. cf. subequalis</i> Hall. ....						c
<i>Syringothyris carteri</i> Hall. ....					c	C
<i>Ambocalia gregaria</i> Hall. ....		C	C	c		
<i>Leiorhynchus dunbarens</i> sp. nov. ....			r	r		
<i>L. madisonense</i> sp. nov. ....		C	C	c		
<i>L. madisonense</i> var. <i>gibbosum</i> var. nov. ....		C	C	c		
<i>L. utahense</i> var. <i>ventricosum</i> var. nov. ....			c	c		
<i>L. jeffersonense</i> sp. nov. ....			r	r		
<i>L. mesacostale?</i> Hall. ....	c	C	C	c		
<i>L. cf. laura</i> (Billings). ....		R	R			
<i>Camarotoechia contracta</i> Hall. ....	c	C	C	C		
<i>C. metallica?</i> (White)? ....						c
<i>Cleiothyridina devonica</i> Raymond. ....	c	C	C	C		
<i>C. sublamellosa?</i> ....					R	R
<i>Meristella barrisi</i> Hall. ....		r				
<b>Protremata.</b>						
<i>Schizophoria striatula</i> var. <i>australis</i> Kindle. ....		C	C	c		
<i>Rhipidomella vanuxemi</i> Hall. ....				c	C	
<i>Schuchertella chemungensis</i> var. <i>arctostriata</i> (Hall)....		c	c	C		
<i>S. crenistria</i> (Phillips)? ....						c
<i>S. inflata</i> (White & Whitfield). ....					r	C
<i>Productella coloradensis</i> Kindle. ....		C	C	c		
<i>P. coloradensis</i> var. <i>plicata</i> Kindle. ....		R	R			
<i>P. laminata</i> Kindle. ....		c	c			
<i>P. spinigera</i> Kindle. ....		C	C	c		
<i>P. cf. depressa</i> Kindle. ....			r			
<i>P. cf. hirsuta</i> Hall. ....		C	c			
<i>P. cf. hirsutiformis?</i> Walcott. ....		R				
<i>P. cf. subaculeata</i> Walcott. ....		c	c	c		
<i>P. subalata?</i> Hall. ....		r				
<i>P. cf. arctirostrata</i> Hall. ....				c	c	c

FAUNAL LIST OF THE THREE FORKS FORMATION.—*Continued.*

	5			4	3	1
	L.	M.	U.			
<b>MOLLUSCA.</b>						
<b>Pelecypoda.</b>						
<i>Lyriopecten fasciatus</i> Hall. . . . .			C	C	r	
<i>L. cf. solox</i> Hall. . . . .			R			
<i>L. cf. polydorus</i> Hall. . . . .			R			
<i>L. sp. nov.?</i> . . . . .			C	C		
<i>Crenipecten amplius</i> Hall. . . . .			r	r		
<i>C. glaber</i> Hall. . . . .			R	R		
<i>Aviculopecten fasciculatus</i> Hall. . . . .			R			
<i>A. cf. celsus</i> Hall. . . . .			R			
<i>A. cf. princeps</i> Hall. . . . .			R			
<i>Aviculopecten</i> sp.? . . . . .			R			
<i>Pterinopecten imbecilis</i> Hall. . . . .			R			
<i>P. vertumnus</i> Hall. . . . .			R			
<i>Pterinopecten</i> sp.? . . . . .			R			
<i>Actinopteria boydi</i> Hall. . . . .			R			
<i>A. æmiliana?</i> = <i>Avicula æmiliana</i> Frech. . . . .			R			
<i>Actinopteria</i> sp.? . . . . .			R			
<i>Loxopteria holzapfeli</i> Raymond. . . . .	c		c			
<i>Loxopteria clarkei</i> Raymond. . . . .	R		R			
<i>Leptodesma sociale?</i> Hall. . . . .			R			
<i>Leptodesma</i> sp.? . . . . .			r			
<i>Glyptodesma cf. erectum</i> Hall. . . . .				R		
<i>Mytilarca chemungensis?</i> Conrad. . . . .			r			
<i>Modiomorpha</i> sp.? . . . . .			c	c	c	
<i>Nucula</i> sp.? . . . . .	c		c	c	c	
<i>Grammysia subarcuata</i> Hall. . . . .					r	
<i>Grammysia</i> sp.? . . . . .	c		c	c	c	
<i>Goniaphora cf. hamiltonensis</i> Hall. . . . .			c	c	c	
<i>G. cf. subrecta</i> Hall. . . . .	c		c	c		
<i>Palæanatina</i> sp.? . . . . .			r			
<i>Leda</i> sp.? . . . . .			R			
<i>Schizodus cf. appressus</i> Hall. . . . .			R			
<i>Cf. Edmondia philipi</i> Hall. . . . .			R			
<i>Macrodon chemungensis</i> Hall. . . . .			c	c	c	
<i>Pthonia cf. cylindrica</i> Hall. . . . .			R			
<i>Cf. Palæoneilo brevis</i> Hall. . . . .			R			
<i>Spathella cf. typica</i> Hall. . . . .			R			
<i>Paracyclas</i> sp.? . . . . .			r			
<i>Cypricardella</i> sp.? . . . . .			R			
<i>Cypricardinia</i> sp.? . . . . .			r	r		
<b>Gastropoda.</b>						
<i>Phanerotinus</i> sp.? . . . . .					r	
<b>Conularida.</b>						
<i>Conularia</i> sp.? . . . . .				r	r	
<b>Nautiloidea.</b>						
<i>Orthoceras montanense</i> Raymond. . . . .	c		c			
<i>Geisonoceras normale</i> Raymond. . . . .	c		c			
<i>G. accelerans</i> Raymond. . . . .	r		r			

FAUNAL LIST OF THE THREE FORKS FORMATION.—*Concluded.*

	5			4	2	1
	L.	M.	U.			
<b>Ammonoidea.</b>						
<i>Platyclymenia americana</i> Raymond.....	C	C	C			
<i>Platyclymenia polypleura</i> Raymond.....	C	C				
<i>Prolobites simplex</i> Raymond.....	C	C				
<i>Tornoceras crebrisepalum</i> Raymond.....	C	C				
<i>T. douglassi</i> Raymond.....	r	r				
Crinoid stems.....	C	C	C			
Bryozoa, cf. <i>Edriotrypa</i> sp.?.....		C	C			

lection made for the Museum of Comparative Zoology. In the faunal list compiled by the writer, which immediately follows, only the species identified by him are included, and their comparative abundance and horizon are indicated by the letters *R* = very rare, *r* = rare, *c* = common, and *C* = very common, in the column with the number of the member in which they occur. The localities are not indicated on the faunal list because no difference was found in the fauna of the formation at the different localities. Most of the collecting was done at Logan and in the east and west valleys north of Three Forks, but enough specimens were collected from the other localities to show that the same species occur at the same horizons throughout this region.

This list of fossils identified by the writer from the Three Forks formation shows among other things (1) that the ammonoids are almost entirely limited to the lower and middle part of member 5, and (2) that members 1 and 2 contain a fauna which is different in most of its forms from that of the lower members, and is more like that of the Madison limestone which overlies member 1. The fauna of the yellow sandstone and shale is considered by Dr. Raymond<sup>15</sup> to be transitional between the Lower Mississippian fauna of the Madison limestone and the Upper Devonian fauna of members 4 and 5 of the Three Forks Formation.

Dr. Schuchert<sup>16</sup> has examined Dr. Raymond's specimens and notes the presence of *Syringothyris carteri* and *Spirifer cf. striatus*, and considers that this faunule is like that of the lower Louisiana limestone of Pike County, Missouri. He therefore concludes that there was a "break in deposition, clearly distinguishing the Devonian, both physically and faunally, from the Mississippian."

<sup>15</sup> Raymond, *Am. Jour. of Sci.*, Ser. IV, Vol. XXIII, 1907, p. 119.

<sup>16</sup> Schuchert, *Bull. Geol. Soc. Am.*, Vol. XX, 1910, p. 546.

The writer has made a careful study of these horizons in the field, and was unable to find any indication of unconformity in the section in this part, and concluded, that, although *Spirifer whitneyi* and other typical Upper Devonian forms present in 4 and 5 were not found in members 1 and 2, as noted by Dr. Raymond, certain forms, such as *Rhipidomella vanuxemi*(?) and *Productella cf. arctostriatus* were sufficiently abundant in both the gray limestone, number 4, and the yellow shale, number 2, which almost immediately overlies number 4 at Logan, where this careful study was made, to indicate that there is no sharp break in the record here. *Syringothyris carteri* was found in the yellow shale within six feet of the top of number 4, and in the same layers with *R. vanuxemi*(?). In the overlying yellow calcareous sandstone *S. carteri* is common, and is associated with *Schuchertella inflata* and *Productella cf. arctirostrata*, and certain doubtfully identified *Spirifers*. This faunule, although containing many lower Mississippian forms, is considered by the writer to be sufficiently different from the fauna in the overlying Madison limestone, which is regarded as Kinderhook, or basal Mississippian, to be considered transitional, as Dr. Raymond has suggested.

*Syringothyris carteri* is generally regarded as an index of Mississippian age, but this seems to be a case where it extends down as far as uppermost Devonian strata. Other species of *Syringothyris* have been reported from Middle or Upper Devonian strata in various parts of the Mississippi valley, and this genus is now regarded by Dr. Schuchert<sup>17</sup> as having originated in the Cordilleran sea during later Devonian time.

The typical faunule of the Three Forks Formation, collected from members 4 and 5, is similar in certain of its forms to that of the lower Ouray limestone of Colorado and also to some of the Upper Devonian forms of the eastern United States. It compares closely with certain European faunules, especially those from near the Ural Mountains.

Dr. Th. Tschernyschew<sup>18</sup> in 1887 made the following correlation of the Upper and Middle Devonian Formations of the Urals, Germany, and eastern North America:

<sup>17</sup> Schuchert, *Am. Jour. Sci.*, Ser. IV, Vol. XXX, 1910, p. 223.

<sup>18</sup> Tschernyschew, *Mem. Com. Geol., St. P.*, Vol. III, pp. 172-185, 1887.



	Ural.	Rhein.	North America.
Upper	D.2/3 <i>Clymenia</i> Kalk.	<i>Clymenia</i> zone.	Chemung.
Devonian.	D.1/3 <i>Goniatites</i> and <i>Cuboides</i> zone.	<i>Goniatites</i> zone.  <i>Cuboides</i> zone.	Portage. Naples. Genesee.
Middle	D.2/2 <i>Sp. annosofi</i> and		
Devonian.	<i>Stringocephalus</i> .	<i>Stringocephalus</i> zone.	Hamilton group.

The Upper Devonian of the western border of the Ural Mountains is divided by Dr. Tschernyschew into two horizons. The upper horizon is correlated with the *Clymenia* horizon of Enkeberg, Fichtelgebirge, Saxony, Thüringerwald, and Cornwall, and is characterized by *Clymenia annulata*, *Clymenia flexuosa*, *Tornoceras simplex*, *Spirifer archiaci*, *Spirifer disjunctus*, *Rhynchonella acuminata*, *Camarophoria* (*Leiorhynchus*) *subreniformis*, *Orthis* (*Schizophoria*) *striatula*, etc. The lower zone is correlated with the *Goniatites* and *Cuboides* horizons of the Eifel and with the Naples fauna of eastern North America, and contains *Goniatites* (*Manticoceras*) *intumescens*, *Tornoceras simplex*, *Atrypa aspera*, *A. reticularis*, *Spirifer disjunctus*, *S. conoideus*, *Rhynchonella* (*Hypothyris*) *cuboides*, etc.

Dr. R. Wedekind<sup>19</sup> has recently made a special study of the Upper Devonian stratigraphy of Germany, and has found that it can be subdivided by characteristic cephalopod faunas into six zones. These zones are named as follows, beginning with the uppermost: VI. *Gonioclymenia*, V. *Lævigata*, IV. *Postprolobites*, III. *Prolobites*, II. *Cheiloceras*, I. *Manticoceras*.

Dr. Wedekind has noted the wide distribution of the *Prolobites* zone IIIb, which he considers is represented by the Three Forks Formation of Montana. Although he does not include any of his other zones in his correlation with the Three Forks Formation, it seems likely that the *Postprolobites* zone is also represented, because *Clymenia annulata* of his zone IVb is closely related to *Platyclymenia americana* of the Three Forks Formation.

Dr. E. Perna<sup>20</sup> has recently correlated the Upper Devonian strata of the eastern Ural Mountains, with those of Westphalia (Enkeberg and Balve) and Silesia, and has shown that the upper horizon of Tschernyschew's classification can be divided into four zones, which

<sup>19</sup> Wedekind, *K. Gesell. d. Wissen. zu Gottingen*, Mathematik-phys. Klasse, 1913.

<sup>20</sup> Perna, *ibid.*

are equivalent to the five upper zones of Dr. Wedekind's classification, and two lower zones, which are equivalent to the *Manticoceras* zone.

This sixfold division is not widely applicable and therefore is of little assistance in correlation with the American Upper Devonian formations, where the brachiopod fauna is much more abundant than the cephalopod fauna.

Apparently the cephalopods are the only abundant fossils in the German Upper Devonian, and for that reason the brachiopods are not mentioned. It is therefore possible to make a much closer correlation between the Upper Devonian of the Ural Mountains and North America, than between that of Germany and North America. From an examination of the brief lists of fossils, noted in connection with Tschernyschew's two zones of the Upper Devonian, it is evident that the upper zone, D<sup>2</sup>, is approximately equivalent to the Three Forks Formation, exclusive of members 1 and 2, and contains many similar fossils, although only a few of the species are the same. This correlation and also the other European correlations place the Three Forks fauna above the *Manticoceras* fauna, and make it the latest Devonian fauna of which we have any record in North America, which is the conclusion at which Dr. Raymond<sup>21</sup> arrived some years ago, before these recent European correlations were made.

#### DESCRIPTION OF THE BRACHIOPODA.

##### Class **BRACHIOPODA.**

##### Order **ATREMATA** Beecher.

##### Superfamily *LINGULACEA* Waagon.

##### Family *LINGULIDÆ* Gray.

##### Genus *LINGULA* Bruguiere.

##### 1. *Lingula hubbardi* sp. nov. (Pl. VII, fig. 1.)

*Description.*—Shell elliptical, width about three-quarters the length; base regularly rounded; sides gently curving; apex obtuse, with an angle of about 115°. The shell has a narrow flattened border about one millimeter wide. The surface is marked by fine concentric striæ, also by fine radiating striæ on the middle portion. These striæ are somewhat wavy about two-thirds of the way from the apex to the margin. The substance of the shell is thin, glistening, brownish black,

<sup>21</sup> Raymond, Proc. 7th Internat. Zool. Cong., Camb., Mass., 1910.

brittle material. The type specimen has a height of 18.5 mm. and a width of 14.5 mm., with the ratio of 1 : .79.

*Locality*.—A single very perfect valve was collected from the limestone in the green shale member (number 5) in the "east" valley, north of Three Forks. A somewhat smaller and less perfect specimen was collected by Dr. Raymond in 1903, from near this same locality. This type appears to be different from any figured species and so the writer has placed it in a new species which is named in honor of Mr. G. E. Hubbard, who found the specimen while aiding the writer in his geological work near Three Forks.

#### Order **NEOTREMATA** Beecher.

##### Family DISCINIDÆ Gray.

#### 2. **Orbiculoidea lodiensis** (Vanuxem). (Plate VII, fig. 4.)

*Orbiculoidea lodiensis* VANUXEM, Geol. N. Y., Rept. 3d Dist., 1842, Pl. 163, fig. 1;

HALL, *Ibidem*, Rept. 4th Dist., 1843, p. 223, fig. 1.

*Discina lodiensis* WALCOTT, Mono. VIII, U. S. Geol. Surv., pp. 112-113, Pl. 2, fig. 5, 5a.

A few specimens from the middle of member number 5, collected by Dr. Raymond and the writer, were identified as *Orbiculoidea* sp. and one or two of the best preserved specimens were identified as *Orbiculoidea lodiensis* Vanuxem, on their general agreement with the description and figures of the Nevadan form from the White Pine Shale as noted by Dr. Walcott.

#### Order **TELOTREMATA** Beecher.

##### Family SPIRIFERIDÆ King.

##### Genus SPIRIFER Sowerby.

#### 3. **Spirifer raymondi** sp. nov. (Pl. V, figs. 1-2; Pl. VI, figs. 12-13.)

*Cf. Spirifer pinonensis*, MEEK, King, 40th Parl. Surv., p. 45, Pl. 1, figs. 9a, b.

*Cf. Spirifer pinonensis* RAYMOND, Ann. Carnegie Mus., Vol. V, 1909, p. 143.

*Cf. Spirifer argentarius* KINDLE, Bull. Am. Pal., No. 20, 1908, p. 32, Pl. 2, fig. 4.

This form is apparently identical with the specimen figured by Dr. Raymond from the red shale as *Spirifer pinonensis*. About sixty specimens from the green shale and associated limestone were carefully studied by the writer, and they show marked differences from *S. pinonensis* as figured and described by Mr. Meek. These differences are as follows:

The shape of the shell is not semicircular in outline, but is triangular, and much like that of *S. mucronatus* Conrad. The cardinal margin terminates in acute and not rectangular or obtuse extremities. The proportions of height to width are different. *Spirifer pinonensis* has a ratio of .76 : 1 and a height of .92 in. and a width of 1.20 in. Six specimens of *Spirifer raymondi* were measured and gave the following dimensions: I. Height 12 mm.; width 25 mm.; ratio .48 : 1. II. Height 15 mm.; width 30 mm.; ratio .5 : 1. III. Height 11.5 mm.; width 21 mm. ratio, .54 : 1. IV. Height 13 mm.; width 23 mm.; ratio .56 : 1. V. Height 14 mm.; width 24 mm.; ratio .58 : 1. VI. Height 20 mm.; width 30 mm.; ratio .66 : 1.

Specimens of *S. pinonensis* have from eleven to fourteen rounded plications on each side of the mesial fold and sinus, and these plications are covered with radiating striæ. *Spirifer raymondi* has from nine to twelve rounded radiating plications on each side of the mesial fold and sinus, and in no specimen were more than twelve plications observed. No minute striations were seen on the plications of any of the specimens. All of the well-preserved specimens of *S. raymondi* show a slight fold in the middle of the sinus, and the surfaces of both valves are marked with rather fine undulating lines of growth.

Specimens from the Jefferson limestone near Princeton, Montana, have been by Dr. Kindle, referred for comparison to *Spirifer argentarius* Meek, which Dr. Schuchert believes to be the same as *S. pinonensis* Meek. The specimen figured by him is apparently identical with the average specimen of *Spirifer raymondi*.

Four specimens of the European species *Spirifer elegans* Stein, in the Museum of Comparative Zoölogy (Schultze's Collection) show a very marked resemblance to the specimens of *Spirifer raymondi*. The points of difference are that the specimens of *S. elegans* are one-third to one-half larger than *S. raymondi*, and the delthyrium in *S. elegans* is an equilateral triangle, while in *S. raymondi* its height is to its width as 1 : .6. The sinus in *S. elegans* is also somewhat broader and perfectly smooth.

On account of all of these differences from any described forms, it seems advisable to place these specimens from the Three Forks Formation under the new specific name *Spirifer raymondi*. This new species is named in honor of Dr. Raymond who collected the first specimens from Three Forks. The type is in the Carnegie Museum.

*Locality*.—Specimens of *Spirifer raymondi* are numerous in the



green shale and limestone bands of No. 5 at all of the localities where specimens were collected.

4. *Spirifer whitneyi* Hall. (Pl. V, fig. 5; Pl. VI, figs. 8-11. Cf. Pl. VIII, fig. 7.)

*Spirifer whitneyi* HALL, Geol. Surv. Iowa, pt. 2, 1858, p. 502, Pl. 4, fig. 2.

*Spirifer whitneyi* KINDLE, Bull. U. S. G. S., No. 391, 1909, p. 24.

A large number of specimens of spirifers with plicated fold and sinus were collected from the gray limestone, number 4, and the green shale, number 5, by Dr. Raymond, for the Carnegie Museum in 1905, and by the writer in 1912 and 1913 for the Museum of Comparative Zoölogy. These specimens have been carefully studied by the writer and compared with New York and European forms of *Spirifer disjunctus* Sowerby = *S. verneuili* Murchison, and also with specimens of *Spirifer whitneyi* from Lime Creek, Iowa. The results of this comparative study are as follows:

The specimens of *Spirifer disjunctus* from the Chemung formation of New York are similar to those of the de Koninck Collection from Sougniez Province, Liège, and from Colonster and Traipont. In general they are mucronate and rather large forms, with simple rounded plications. They are all very different from the specimens from Montana. Certain of the European forms identified as *Spirifer disjunctus*, from Boulonnais (Duval and de Koninck collections), are of the same shape and size as specimens of *Spirifer whitneyi* from Lime Creek, Iowa. The European specimens, however, all lack the fine striations on each plication which are characteristic of *Spirifer whitneyi*.

Some of the specimens from Montana have the same measurements and appearance as *Spirifer whitneyi* from Lime Creek, and in a few cases the surface is well enough preserved to show traces of fine striations on the plications. They have therefore been identified as *Spirifer whitneyi* Hall. A comparison of the measurements of the Boulonnais, Lime Creek, and Montana specimens is as follows:

*Spirifer disjunctus* Sow. from Boulonnais. Ratio (1), width on hinge line to height of brachial valve measured over the surface, from 1 : .53 to 1 : .71 majority of specimens 1 : .66. Ratio (2), width on hinge line to height of area: range 1 : .143 to 1 : .27, majority 1 : .21. Ratio (3), height to width of delthyrium; range 1 : .6 to 1 : 1, majority 1 : 1.



*Spirifer whitneyi* Hall. Lime Creek, Iowa.

Ratio (1), range 1 : .6 to 1 : .77. Ratio (2), range 1 : .23 to 1 : .24. Ratio (3), range 1 : .86 to 1 : 1.

*Spirifer whitneyi* Hall. Three Forks, Montana.

Ratio (1), range 1 : .47 to 1 : .69. Ratio (2), range 1 : .17 to 1 : .27. Ratio (3), range 1 : .5 to 1 : .8. An average specimen from Three Forks has a width of 32 mm. a height of 21 mm., height of area of 7 mm., and width of delthyrium of 5.7 mm.

The number of plications on each side of the brachial valve and the number on the fold is as follows:

*Spirifer disjunctus* from Boulonnais, 18 to 31 on a side, majority 21; 9 to 13 bifurcating plications on the fold, majority of specimens have 11.

*Spirifer whitneyi* from Lime Creek, 16 to 26 on a side, and 7 to 12 on the fold.

*Spirifer whitneyi* from Three Forks, 16 to 26 on a side; majority 21; and 8 to 15 on the fold.

##### 5. *Spirifer whitneyi* var. *animasensis* (Girty). (Plate V, figs. 11-13.)

*Spirifer disjunctus* var. *animasensis* Girty, Twentieth Ann. Rept. U. S. G. S., pt. 2, 1900, p. 48, Pl. 4, figs. 1-10.

*Spirifer whitneyi* var. *animasensis* (Kindle), U. S. G. S. Bull. 391, p. 25, Pl. 9, figs. 1-3.

About twenty of the spirifers from the Three Forks Formation have been identified by the writer as *Spirifer whitneyi* var. *animasensis* (Girty). These specimens are somewhat smaller than *Spirifer whitneyi* and they all show a relatively high area with frequently a slightly twisted ventral beak, and they compare well with the specimens figured by Drs. Girty and Kindle. The ratio of the width to the height of the brachial valve in the Montana specimens range from 1 : .5 to 1 : .76 and the ratios of width to height of area from 1 : .28 to 1 : .33. The ratios of the height to the width of the delthyrium range from 1 : .46 to 1 : 1. The ratios of the specimens of *Spirifer disjunctus* var. *animasensis* Girty are, width to height of area 1 : .23 to 1 : .36; height to width of delthyrium 1 : .75 to 1 : 1.

The specimens from the Three Forks Formation have from thirteen to twenty-one simple radiating plications on each side of the fold, and from nine to fourteen bifurcating plications on the fold. The presence of traces of striæ on some of the plications shows that this form is more

closely related to *S. whitneyi* than to *S. disjunctus*, as was pointed out by Dr. Kindle. The size of an average specimen from Montana is: width 30 mm.; height 19 mm.; height of area 9 mm.; width of delthyrium 5.5 mm.

6. *Spirifer whitneyi* var. *gallatinensis*, var. nov. (Pl. V, figs. 3-4; Cf. Pl. VIII, fig. 12).

About twenty-five specimens of the same general form as those just described, show a very different type of area and on this account have been described as a new variety, *gallatinensis*. These specimens have a rather narrow area, which is usually flat, or only slightly curved, although the beak of the pedicle may be strongly incurved. The area is of equal width throughout its whole extent, and usually extends at right angles to the hinge-line. The area generally shows distinct fine vertical striæ.

The ratios of width to height of brachial valves range from 1 : .52 to 1 : .78. The ratios of width to height of area range from 1 : .125 to 1 : .2. The ratios of width to height of delthyrium range from 1 : .8 to .9 : 1. The size of an average individual is, width 29 mm.; height 19 mm.; height of area 4 mm.; width of delthyrium 4 mm. There are from sixteen to twenty-six plications on each side of the shell, and from nine to fifteen bifurcating plications on the fold. Some of the specimens show striations on the plications, and this and the general shape of the shell indicates a close relationship with *Spirifer whitneyi*. The type is in the Museum of Comparative Zoölogy.

Some of the specimens of *Spirifer disjunctus* from Europe (locality Try près Walfourt) show a type of area with parallel sides similar to *Spirifer whitneyi* var. *gallatinensis*. (Cf. Pl. VIII, fig. 12.) Ratios from the European specimens show a range in width to height of brachial valve from 1 : .4 to 1 : .56, and a range in width to height of area from 1 : .1 to 1 : .2, and a range in height to width of delthyrium from 1 : .62 to 1 : 1. None of these specimens show traces of striations on the plications.

This close resemblance between certain specimens of *Spirifer disjunctus* from Boulonnais, and *Spirifer whitneyi*, and certain specimens of *Spirifer disjunctus* from Try près Walfourt and *Spirifer whitneyi* var. *gallatinensis* shows that we have here a good example of parallel development in two very similar species of spirifers. Each species has developed similar variations in regard to the shape of the shell

and the area. In cases where the striations are preserved on the specimens from western America it is easy to refer them to the species *whitneyi*, but the majority of the specimens are exfoliated, and they therefore come within the limits of the species *disjunctus*. This is undoubtedly the reason why so many of the western American species of this general type have been identified as *Spirifer disjunctus*. The wide variations in the European specimens of *Spirifer disjunctus* = *Spirifer verneuili* show that varietal differences have been overlooked in the identification of the specimens.

7. *Spirifer whitneyi* var. **monticola**, var. nov. (Pl. V, figs. 6-10;  
Pl. VI, figs. 1-7).

Cf. *Spirifer whitneyi* KINDLE, Bull. No. 391, U. S. G. S., p. 24, Pl. 8, figs. 2-5.

By far the commonest of the specimens of *Spirifer* from Montana is a robust form with a relatively short hinge-line. Several hundred specimens of this variety were collected by Dr. Raymond and the writer from all of the localities where the Three Forks Formation is well exposed. These specimens are apparently identical with those from the Ouray limestone of Colorado and New Mexico, which are figured by Dr. Kindle and identified as *Spirifer whitneyi*. Dr. Kindle notes the fact that the forms from Colorado and New Mexico are more robust and have flatter and broader plications than the Iowa specimens. He considers it undesirable to make a new species based on these differences, because *Spirifer disjunctus* is such a variable type.

A study of the large collection of specimens from the Three Forks formation has convinced the writer that these specimens show certain characters which are sufficiently distinct from *Spirifer whitneyi* to be the basis for a new variety, *monticola*.

A series of seven specimens (See Pl. VI) was selected to show variation in shape in the new variety. The ratios between the width and height of the brachial valves are as follows: (a) .84 : 1; (b) .88 : 1; (c) .93 : 1; (d) 1 : 1; (g) 1 : .97; (e) 1 : .81; (f) 1 : .78. The ratios of the width to the height of the area are as follows: (a) 1 : .152; (b) 1 : .227; (c) 1 : .232; (d) 1 : .3; (e) 1 : .325; (f) 1 : .345; (g) 1 : .39. It is interesting to note that with the exception of specimen, g, the increase in the height of the area and its flattening-out follows directly the increase in length of the hinge-line.

A comparison of these ratios with those of *Spirifer whitneyi* from Lime Creek show that all of the western specimens have a shorter



hinge-line and relatively higher brachial valve than the specimens from Iowa. Furthermore all the western specimens are more robust, and have a ratio between the length of hinge and the maximum thickness of the specimen which ranges from 1 : .86 to 1 : .54, while the same ratios for specimens of *Spirifer whitneyi* from Iowa range from 1 : .5 to 1 : .46.

A large percentage of the well-preserved specimens of *Spirifer whitneyi* var. *monticola*, show fine striæ on the rather broad, flattened, radiating plications. The plications vary in number from thirteen to twenty-nine on a side, and from nine to nineteen on the fold. The size of a moderately small individual is: width 22 mm., height 25 mm., height of area 5 mm., width of delthyrium .45 mm., thickness 19 mm. The measurements of a rather large individual are: width 37 mm., height 30 mm., height of area 12 mm., width of delthyrium 9.5 mm., thickness 26 mm. Specimens from the fissile green shales of number 5 are much better preserved than those from the limestone layers. Almost all of the specimens from the shale show the characteristic striations on the plications, and some show a tendency to develop alate, almost spiniform, hinge extremities.<sup>22</sup> Such delicate spinose points are preserved in only a few of the specimens from the shale, so that it seems likely that this is an abnormal feature and not a general character.

About fifteen of the specimens, including Nos. 174 *a*, *b*, and *c*, of the series just mentioned, and specimens numbered 172*c* and *d*, and 176 *a* and *b*, show under the hand-lens, or microscope, a spinose surface covering the plications. The character of this surface varies from numerous irregularly scattered small rounded spines,<sup>23</sup> as seen on specimens 172*d* or 174*a* to elongate spine bases arranged in radiating rows (See Pl. V, figs. 7, 8, 9,), which under slight magnification appear continuous, and therefore like the normal striæ. Upon a closer examination they appear to be an intermediate stage between the normally striated specimens and the irregularly spinose individuals. Since there is this gradation in surface character on specimens, which in other respects are identical, it seems best to note it merely as a variable detail in *Spirifer whitneyi* var. *monticola*. Specimens from the green shale almost always have the details of the surface well-preserved and it is from a study of these that the intermediate stages

<sup>22</sup> See Plate V, fig. 6.

<sup>23</sup> See Plate V, fig. 10.

between the normally striate and the irregularly spinose types were made out. The type is in the Carnegie Museum.

*Locality*.—Specimens of *Spirifer whitneyi* and its varieties were obtained from the gray limestone, number 4, and the green shale number 5, at all of the localities studied in detail by the writer, where the Three Forks Formation is exposed in the region about Three Forks and to the north.

Genus AMBOCÆLIA Hall.

8. *Ambocœlia gregaria* Hall.

*Ambocœlia gregaria* HALL, 13th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 81.

*Ambocœlia gregaria* RAYMOND, Ann. Carnegie Mus., Vol. V, 1909, p. 143.

Specimens referred to this species are very common in certain of the limestone bands in the green shale, number 5, particularly at Three Forks and Logan. The brachial valves show the well-marked sinus, which characterizes this species.

*Locality*.—Green shale, member number 5, at Three Forks, Logan, and localities to the north.

Family RHYNCHONELLIDÆ Gray.

Genus LEIORHYNCHUS Hall.

9. *Leiorhynchus dunbarens* sp. nov. (Plate VIII, fig. 8.)

*Cf. Leiorhynchus astabulense* PROSSER, Ohio Geol. Surv., 4th ser., Bull. 15, 1913.

Shell very gibbous and wide in comparison with its height. The ventral valve is slightly convex and the beak rather prominent. The mesial sinus becomes very deep toward the margin and contains two rather low, rounded plications. The sinus is bordered by two large rounded plications, with usually two less elevated, rounded plications on either side, the outermost usually faintly defined. The dorsal valve is very convex and strongly incurved at the umbo, and rises somewhat above the ventral valve. The surface is marked by a high fold with three rather angular plications. The sides have one strongly marked plication next to the fold, and usually two less distinct, low, rounded plications nearer the lateral margins. The surface of the well-preserved specimens is covered with strong, concentric, imbricated growth-lines. The dimensions of the type specimen are: width 27 mm., height 16 mm. Another specimen has a width of 22 mm., and a height of 14 mm. The type is in the Carnegie Museum.

This species resembles *Leiorhynchus astabulense* Prosser in many

respects, but the ratio of width to height in *Leiorhynchus dunbarens* is 1 : .6 instead of 1 : .9 as in *L. astabulense*, and the sides have fewer plications. The type is in the Carnegie Museum.

*Locality*.—Five specimens of this species were collected from the limestone layers at the top of member number 5, near Dunbar's mine, north of Three Forks. Three of them were collected by Dr. Raymond in 1905 and two of them by the writer in 1912. One very well preserved specimen was obtained by the writer in 1913 from the base of gray limestone number 4, from east of Lombard, Montana.

10. *Leiorhynchus madisonense* sp. nov. (Plate VII, figs. 11-13.)

Outline of shell oval; width always greater than height; the ratio varies from 1 : .64 to 1 : .76. An average specimen has a width of 19 mm. and a height of 14 mm., with a ratio of 1 : .73.

The pedicle valve curves to the sides and has a well marked, rather broad sinus, developed slightly above the middle of the shell. Beak small and closely incurved over the umbo of the opposite valve.

The brachial valve is much more convex than the pedicle, and rounds to the sides. Mesial fold well-developed in most cases, and greatly elevated at the outer border. Surface marked by fine imbricating concentric striæ, also by fine radiating striæ, which are well-developed on the sides of the shell. The sinus is generally characterized by two rounded plications, rarely one or three. The fold is usually marked by three, sometimes two, or four, plications. Sides of the shell usually marked by one or two faint, low, rounded plications. These plications all extend to the apex of the shell. The type is in the Carnegie Museum.

This species differs from *Leiorhynchus mesacostale* in the smaller number of plications in the fold and sinus, and in the greater width of the shell in relation to its height.

*Locality*.—Specimens are numerous in the green shale and associated limestone layers of member number 5, at Three Forks, Logan, and most of the other localities in the region near Three Forks.

11. *Leiorhynchus madisonense* var. *gibbosum* var. nov. (Plate VII, figs. 14-16.)

*Cf. Leiorhynchus kellogi* HALL, Pal. N. Y., Vol. IV, p. 361, Pl. 56.

Shell more gibbous and usually larger than *Leiorhynchus madisonense*. An average specimen has a width of 23 mm. and a height of 20 mm.,



with a ratio of width to height of 1 : .87. A smaller specimen has a width of 19 mm. and a height of 15 mm., and a ratio of 1 : .79. The range in the ratio of width to height is from 1 : .77 to 1 : .89.

The valve of the pedicle is gibbous a little below the umbo, and curves evenly to the sides. It becomes flattened in the middle and is deeply sinuate toward the front of the shell. The beak is closely incurved over the umbo of the brachial valve.

The brachial valve is more convex than the pedicle and curves to the sides, with a broad, flattened mesial fold, well-developed from the upper third of the shell.

The surface is marked by fine concentric striæ and also by fine radiating striæ, which are usually most prominent on the sides of the shell. From three to seven low, rounded plications occur in the sinus, and from four to eight in the fold. The specimens usually have from one to three low, rounded plications on the sides of the valves, which diminish in relief toward the lateral margins. All of the plications radiate from the beaks and they are almost invariably clearly defined from the beaks to the margin of the shell. This new variety differs from *Leiorhynchus madisonense* in the greater convexity of the valves; the normally greater number of plications in the fold and sinus, and in the height and width being more nearly equal.

This new variety differs from *Leiorhynchus kellogi* in the lesser number of plications on each side of the fold and sinus, and in having the plications extending all the way from the margin to the apex, instead of half-way or less, as in *L. kellogi*. The type is in the Carnegie Museum.

*Locality*.—Specimens are numerous in the gray limestone, number 4, and also in the green shales, number 5, at Three Forks, Logan, and the other localities in that region. Twenty-four specimens were collected by Dr. Raymond in 1905 and seventeen by the writer in 1912, and about ten in 1913.

12. *Leiorhynchus utahense* var. *ventricosum* var. nov. (Plate VIII, figs. 10–11.)

*Cf. Leiorhynchus utahensis* KINDLE, Bull. Am. Pal., No. 20, p. 27, Pl. 3, figs. 1–10.

*Cf. Leiorhynchus greencanum* (ULRICH), Cont. Am. Pal., I, 1886, p. 26, Pl. 13, fig. 1.

Shell large, ventricose on brachial side, and flattened on side of pedicle. Ratio of width to height 1 : .94. Thickness usually somewhat less than height. The type specimen has a width of 37 mm.,



height 35 mm., and convexity 28 mm. The largest specimen obtained has a height of 47 mm., a width of 42 mm., and a convexity of 47 mm. This specimen has a ratio of width to height of .89 : 1, and a convexity equal to the height. The cardinal view of all of the specimens is sub-semicircular in outline.

Valve of pedicle gibbous at the umbo, flattened toward the sides, and deeply sinuate toward the front. Beak small, acute, and closely incurved over the umbo and brachial valve. Two low, rounded plications and three broad furrows are present in the sinus, which is scarcely defined at the umbo, but becomes broad and fairly deep at the anterior margin.

Brachial valve ventricose, with a well-defined low fold, consisting of three rather broadly rounded plications, the one in the middle somewhat narrower than the other two.

Surface of both valves marked by fine concentric lines, with more prominent uneven growth-wrinkles at increasingly frequent intervals toward the margin of the valves. The sides of the shell show distinct radiating striations, about four to one millimeter, and there are faint indications of them on the sinus and on a part of the fold.

This form is considered to be a variety of *Leiorhynchus utahense* Kindle, of the Jefferson limestone of Utah, from which it differs in its sub-semicircular and not sub-trigonal outline, and in its larger size, and lesser number of plications in the sinus and fold. The type is in the Carnegie Museum.

It differs from *Leiorhynchus greeneanum* (Ulrich) in its greater height in relation to its width; in having a sub-hemispherical rather than a sub-trigonal cardinal view, and in having the fold clearly marked to the anterior extremity of the valve, and containing three distinct plications, instead of two or three irregular, faint plications.

*Leiorhynchus greeneanum* is a younger form, and occurs in the Keokuk limestone of Indiana.

*Locality*.—Specimens of this new variety were collected from the base of limestone number 4, and the top of green shale number 5, chiefly from Three Forks and Logan. Dr. Raymond collected three specimens in 1905 and the writer collected six in 1912 and ten in 1913.

### 13. *Leiorhynchus jeffersonense* sp. nov. (Plate VIII, fig. 9.)

Shell large, sub-ovate and moderately convex on the brachial side; flattened on the pedicle side. Width of an average specimen 44 mm.;

height 28 mm.; ratio 1 : .635. Width of a smaller individual 38 mm.; height 23 mm.; ratio 1 : .6.

Valve of pedicle flattened toward the sides, with a moderately deep sinus, which starts from the beak. Sinus flat, and bordered by a single, usually prominent, rounded plication on each side. Four or five distinct, evenly spaced, rounded plications in the sinus, and on a few specimens one or two faint plications on the sides of the valve.

Brachial valve convex, with a prominent flat-topped fold, which starts from the beak, and is composed of five or six rounded plications. One or two very low plications are visible on the sides of the valve in a few specimens.

This species differs from *Leiorhynchus utahense* var. *ventricosum*, with which it is associated in the field, in its greater width in relation to its height; in the lesser convexity of the valves, and in the possession of a greater number of plications in the fold and sinus.

One specimen referred to this species was collected by Dr. Raymond in 1905, and eight specimens were collected by the writer in 1912 from the base of the gray limestone, number 4, and the upper limestone in green shale number 5, in the east and west valleys north of Three Forks. In 1913 two well-preserved specimens were obtained from this same horizon near Sappington, and a few were obtained from Logan, and Lombard. The type is in the Museum of Comparative Zoölogy.

#### 14. *Leiorhynchus mesacostale* Hall.

*Leiorhynchus mesacostalis* HALL, 1867, Pal. N. Y., Vol. IV, p. 362, Pl. 67, figs. 18-25.

*Leiorhynchus mesacostale* RAYMOND, Ann. Carnegie Mus., Vol. V, No. 2, 3, 1909.

Fossils referred to this species are fairly common in the limestone and green shale of member number 5, at all of the localities. These are all rather small flattened forms, with the plications limited to the fold and sinus. There are usually three plications in the sinus and four in the fold, but the number is rather variable. They are all evenly spaced, and in that respect differ from *L. mesacostale* as figured by Hall. In general appearance they resemble *Camarophoria subreniformis* which is described by Tschernyschew from the Ural Mountains, but without material for comparison it is not possible to tell how closely these forms compare.

15. *Leiorhynchus cf. laura* (Billings).

*Cf. Leiorhynchus multicosta* HALL, Pal. N. Y., IV, 1867, p. 358, Pl. 56, figs. 26-40.

*Cf. Leiorhynchus clarkei* PROSSER, Ohio Geol. Surv., 4th Ser. Bull. 15, 1913.

Several specimens from the green shale and limestone member, number 5, from Three Forks and Logan, are referred with some doubt to this species. They are small flattened shells with three or four low, rounded plications on each side of the sinus and fold, as well as in the sinus and fold. They compare closely with *L. multicosta* as figured by Hall, but that is a Hamilton form, and these Montana specimens are in a higher horizon. The Montana specimens are also similar to *L. clarkei* Prosser, but are much smaller in size.

## Genus CAMAROTÆCHIA Hall &amp; Clarke.

16. *Camarotæchia contracta* Hall.

*Rhynchonella (Stenocisma) contracta* HALL, 1867, Pal. N. Y., IV., p. 351, Pl. 55, figs. 26-39.

*Camarotæchia contracta?* KINDLE, U. S. G. S. Bull. 391, p. 22, Pl. VI, figs. 1-2a.

*Camarotæchia contracta* RAYMOND, Ann. Carnegie Mus., Vol. V, 1909, p. 141.

Specimens apparently identical with those from Colorado and New Mexico, which are identified as *C. contracta*, occur as one of the most abundant forms in the green shale and limestone member number 5, and also in smaller numbers in the overlying gray limestone, at all of the localities where fossils were collected from the formation by the writer. The specimens vary greatly in the number of plications in the sinus and fold. The average number is three in the sinus and four in the fold, but a considerable number of specimens have more or less. The extreme numbers in the sinus are from two to five, and in the fold from three to six.

## Family ATHYRIDÆ Phillips.

## Genus CLEIOTHYRIDINA Buckman.

17. *Cleiothyridina devonica* Raymond.

*Cleiothyridina devonica* RAYMOND, Ann. Carnegie Museum, Vol. V, 1909, p. 143.

A very large number of specimens of this species were collected by the writer in 1912 and 1913 from the gray limestone number 4, and from the green shale and limestone member number 5, at all of the localities. This species is described in detail by Dr. Raymond from its occurrence at Three Forks and Logan.

## Genus MERISTELLA Hall.

18. *Meristella barrisi* Hall. (Plate VII, fig. 2.)*Meristella barrisi* HALL, Pal. N. Y., Vol. IV, 1867, p. 304, Pl. 49.*Meristella barrisi* KINDLE, Bull. 391, U. S. G. S., p. 30, Pl. 9, figs. 7-9.

Four specimens identified by the writer as of this species, were collected from the limestone layers in the middle part of the green shale, number 5, from the west valley, north of Three Forks. They closely resemble the forms figured by Dr. Kindle from New Mexico, and also those figured by Hall from the state of New York.

## Order PROTREMATA.

## Superfamily STROPHOMENACEA Schuchert.

## Family ORTHIDÆ Dalman.

## Genus SCHIZOPHORIA King.

19. *Schizophoria striatula* var. *australis* Kindle. (Plate VIII, figs. 3-5.)*Schizophoria striatula* var. *australis* KINDLE, U. S. G. S., Bull., 391, p. 21, Pl. 2, figs. 1 and 2.

About thirty specimens identified as this variety, were collected by the writer from the middle and upper part of member number 5 at Three Forks and Logan. The specimens are not as well preserved as those from New Mexico figured by Dr. Kindle, but they resemble them sufficiently closely to make the identification fairly certain.

## Genus RHIPIDOMELLA Oehlert.

20. *Rhipidomella vanuxemi*(?) Hall. (Plate VIII, figs. 3-5.)*Orthis vanuxemi* Hall, 1858, Geol. Surv. Iowa, I, pt. 2, p. 487, pl. 2, figs. 2 and 3.

A large, number of specimens, identified as this species, were collected by Dr. Raymond and the writer from the top of the gray limestone, number 4, and the base of the yellow shale, number 2, chiefly at Logan. A few specimens were obtained from near Sappington and Rekap, and in the east and west valley at Three Forks. The specimens are all nearly circular in outline, and are very flat, with no sinus or fold, and the plications have numerous pores as in *R. vanuxemi*. This horizon is higher than that in which *R. vanuxemi* occurs in New York, but, because of the very close correspondence in shape and details, these forms from Montana are identified with some doubt as belonging to this species.



## Family STROPHOMENIDÆ King.

## Genus SCHUCHERTELLA.

21. *Schuchertella chemungensis* var. *arctostriata* (Hall). (Plate VII, fig. 6.)*Streptorhynchus chemungensis* var. *arctostriata* HALL, Pal. N. Y., Vol. IV, Pl. 9, fig. 1.*Hemipronites chemungensis* var. *arctostriata* MEEK, 40th Parl. Surv., Pl. 3, fig. 2.*Schuchertella chemungensis* var. *arctostriata* (KINDLE), Bull. Am. Pal., No. 20, p. 26. Pl. 2.

About ten specimens, identified as this variety, were collected from the limestone bands in the green shale, number 5, in the valleys near Three Forks, and eight specimens were collected from the same horizon at Logan by Dr. Raymond in 1905 and by the writer in 1912 and 1913. One very well preserved specimen was obtained by the writer in 1913 from the gray limestone member near Sappington. These specimens show a considerable range in size, but they all seem to belong to the same species and variety. The dimensions of an average specimen are: width on hinge 25 mm., height 18 mm. A rather small specimen has a width of 9 mm. and a height of 7.5 mm. All of the specimens show the characters of the variety as noted by Hall. The surface is covered with close, crenulated, radiating striæ, increasing mainly by interstitial addition. The specimens appear to be identical with those figured by Dr. Kindle from the Jefferson limestone of Princeton and Livingston, Montana.

## Family PRODUCTIDÆ Gray.

## Genus PRODUCTELLA Hall.

22. *Productella spinigera* Kindle. (Plate VIII, fig. 3.)*Productella spinigera* KINDLE, Bull. U. S. Geol. Surv., No. 391, p. 19, Pl. V, figs. 1-4.

About twenty-five specimens, identified as this species, were collected by Dr. Raymond and the writer from members numbers 4 and 5 at the various localities. These specimens show very little variation and correspond very well with the description and figures of the Ouray species of Dr. Kindle.

23. *Productella coloradensis* Kindle. (Plate VII, figs. 5 and 7-8.)*Productella coloradensis* KINDLE, Bull. U. S. Geol. Surv., No. 391, p. 17, Pl. IV, figs. 2-8.

About thirty specimens collected by Dr. Raymond and the writer from members 4 and 5 were identified by the writer as this species.

24. *Productella coloradensis* var. *plicata* Kindle.

*Productella coloradensis* var. *plicatus* KINDLE, Bull. U. S. Geol. Surv., No. 391, p. 18, Pl. IV, figs. 9-12.

The writer obtained two well-preserved specimens from the upper portion of member number 5, north of Three Forks, which show the detailed characters of this variety.

25. *Productella laminata* Kindle. (Plate VIII, fig. 6.)

*Productella laminatus* KINDLE, Bull. U. S. Geol. Surv., No. 391, p. 18, Pl. IV, figs. 13-14.

About ten specimens from the upper portion of member number 5 in the collections of Dr. Raymond and the writer were identified as of this species.

26. *Productella* cf. *depressa* Kindle.

*Productella depressa* KINDLE, Bull. U. S. Geol. Surv., No. 391, p. 20, Pl. V, fig. 5, 5a.

Five specimens collected by Dr. Raymond from member number 5 are referred by the writer, with some doubt, to this species.

27. *Productella* cf. *arctirostrata* Hall.

*Productella arctirostrata* HALL, Pal. N. Y., Vol. IV, 1867, p. 182, pl. 26, figs. 16-23.

About thirty poorly preserved specimens from limestone member number 4, and the overlying yellow shale of number 2 are referred to this species with some doubt. Most of the specimens have continuous plications, rather than a row of elongate spine-bases as shown in most of the figures of this species.

The following rather unsatisfactory determinations of poorly preserved *Productellas* are merely listed here without comment. They are all from the upper part of member number 5 or from number 4.

*Productella* cf. *hirsuta* Hall, a rather common form.

*Productella* cf. *hirsutiformis* Walcott, a very rare form in the collections.

*Productella* cf. *subaculeata* Walcott, a rare form.

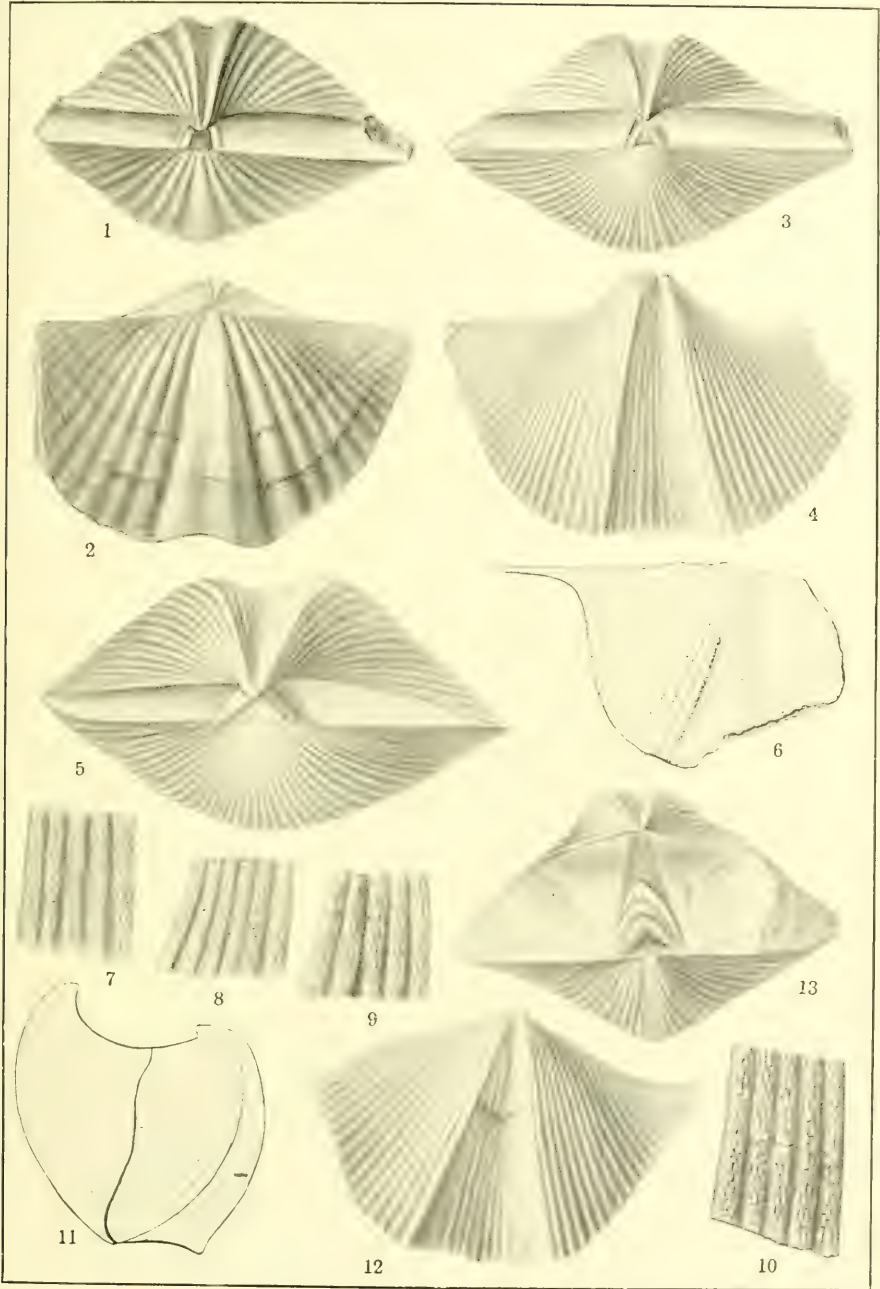
*Productella* cf. *subalata* Hall, a fairly abundant form.

This completes the description of the Brachiopoda from members numbers 4 and 5 of the Three Forks formation. A description of the Pelecypoda of the formation is in preparation for a later paper in this series.



## EXPLANATION OF PLATE V.

- FIG. 1. *Spirifer raymondi* Haynes, sp. nov. (Top view showing shape of area.)  
× 2.
- FIG. 2. *Spirifer raymondi* Haynes, sp. nov. × 2.
- FIG. 3. *Spirifer whitneyi* Hall, var. *gallatinensis* Haynes, var. nov. (Showing parallel-sided area.) × 2.
- FIG. 4. *Spirifer whitneyi* Hall, var. *gallatinensis* Haynes, var. nov. (Ventral valve of specimen shown in Fig. 3.) × 2.
- FIG. 5. *Spirifer whitneyi* Hall. × 2.
- FIG. 6. *Spirifer whitneyi* Hall, var. *monticola* Haynes, var. nov. (Showing spiniform cardinal angle.) × 2.
- FIG. 7. *Spirifer whitneyi* Hall, var. *monticola*. × 4. No. 176b.
- FIG. 8. *Spirifer whitneyi* Hall, var. *monticola*. × 4. No. 172b.
- FIG. 9. *Spirifer whitneyi* Hall, var. *monticola*. × 4. No. 172c.
- FIG. 10. *Spirifer whitneyi* Hall, var. *monticola*. × 4. No. 172d.  
(Figs. 7 to 10 inclusive show details of surface markings.)
- FIG. 11. *Spirifer whitneyi* Hall, var. *animasensis* (Girty). (Side view.) × 2.
- FIG. 12. *Spirifer whitneyi* Hall, var. *animasensis* (Girty). (Ventral valve of specimen in Fig. 11.) × 2.
- FIG. 13. *Spirifer whitneyi* Hall, var. *animasensis* (Girty). (Top view showing high area of same specimen.) × 2.



Brachiopods from Green Shales. (See opposite page.)

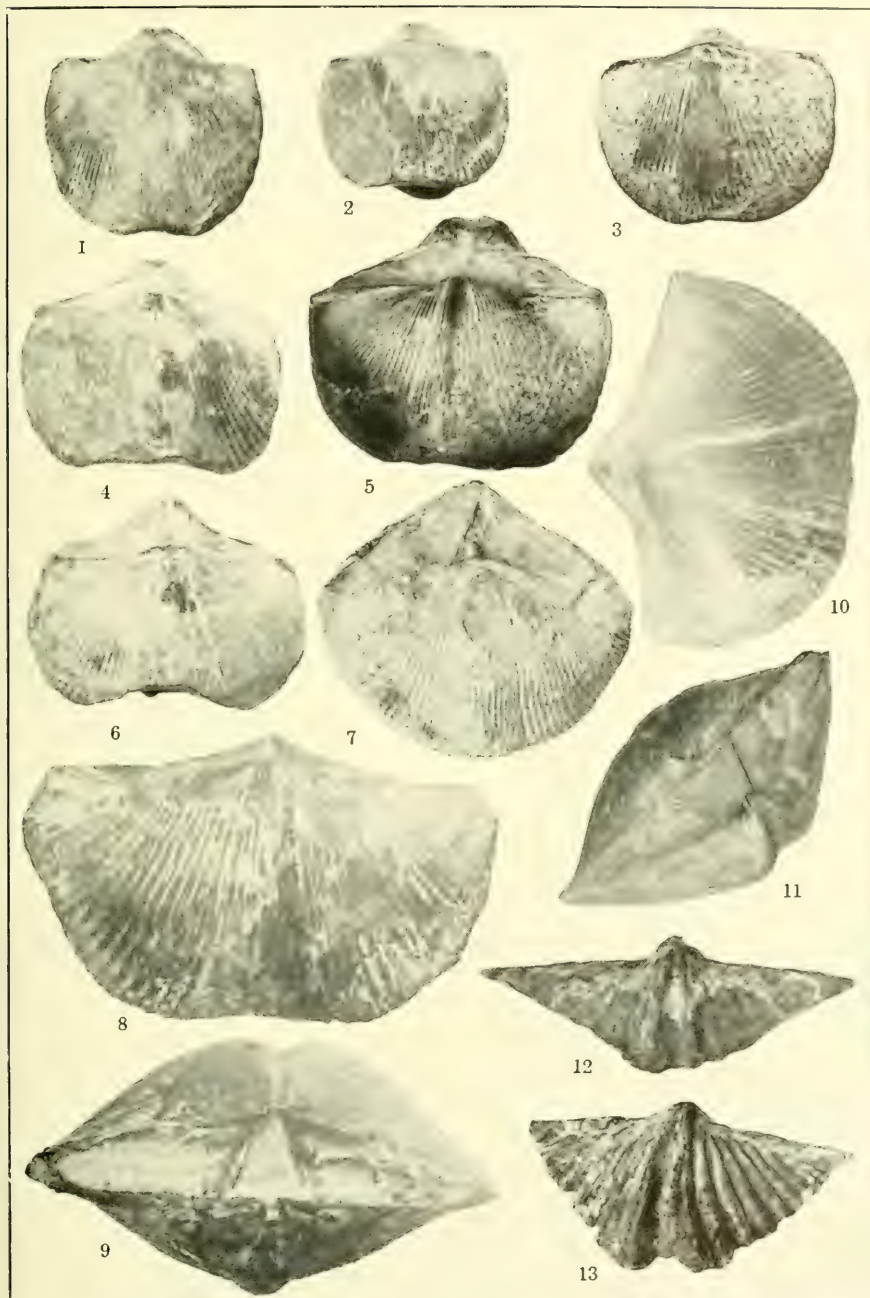






## EXPLANATION OF PLATE VI.

- FIG. 1. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174a.  
FIG. 2. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174b.  
FIG. 3. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174c.  
FIG. 4. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174d.  
FIG. 5. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174e.  
FIG. 6. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174f.  
FIG. 7. *Spirifer whitneyi* Hall, var. *monticola*.  $\times 1$ . No. 174g.  
(Figs. 1 to 7 show variations from a long, narrow form to a short wide form, and also in height of area and length of hinge-line.)  
FIG. 8. *Spirifer whitneyi* Hall.  $\times 2$ .  
FIG. 9. *Spirifer whitneyi* Hall. (Top view of specimen shown in Fig. 8.)  $\times 2$ .  
FIG. 10. *Spirifer whitneyi* Hall. Lime Creek, Iowa.  $\times 2$ .  
FIG. 11. *Spirifer whitneyi* Hall. Lime Creek, Iowa. (Top view of specimen shown in Fig. 10.)  $\times 2$ .  
FIG. 12. *Spirifer raymondi* Haynes. Three Forks, Montana. (Ventral valve of extreme mucronate type.)  $\times 2$ .  
FIG. 13. *Spirifer raymondi* Haynes. Three Forks, Montana. (Exfoliated ventral valve, showing slight fold in sinus.)  $\times 2$ .



Brachiopods from Green Shales. (See opposite page.)

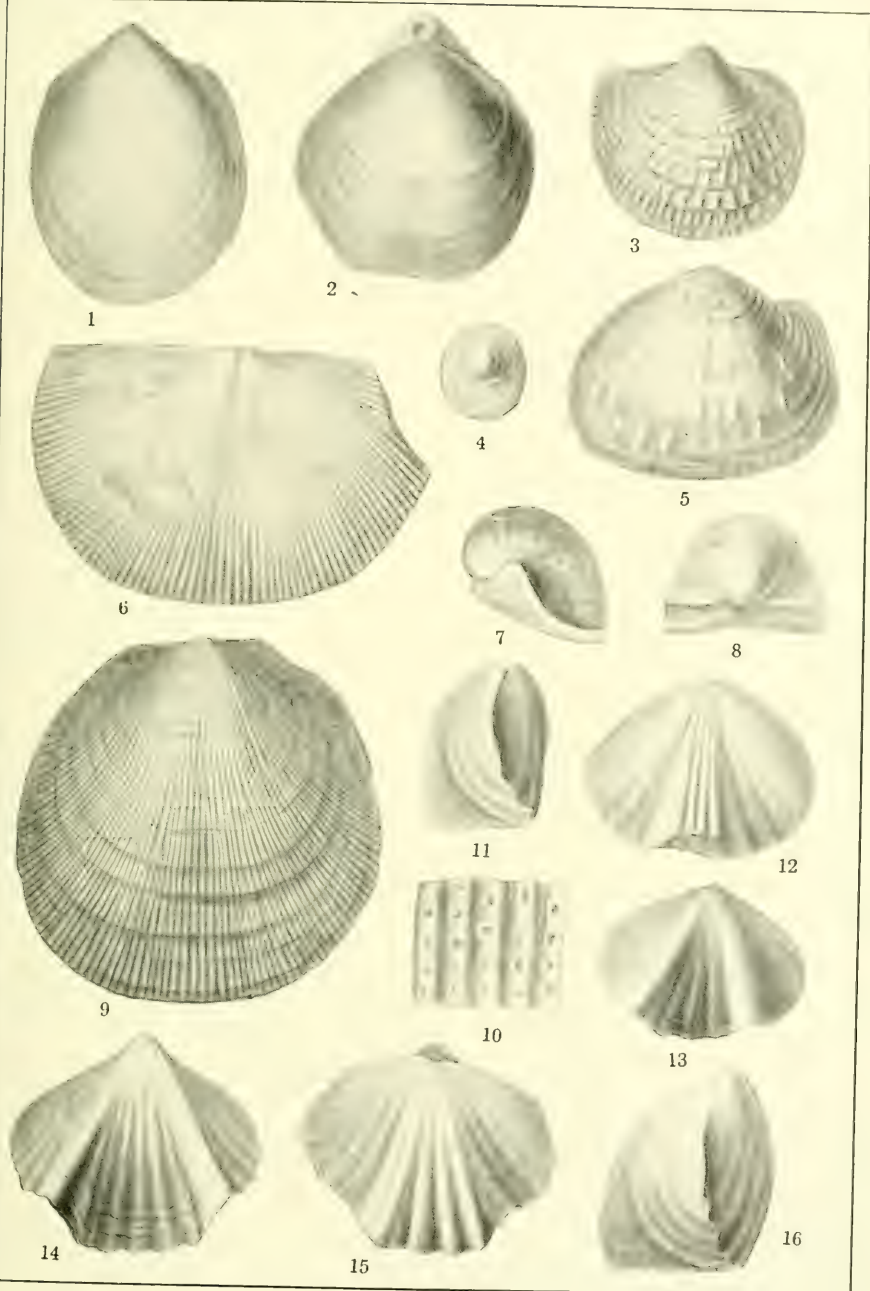






## EXPLANATION OF PLATE VII.

- FIG. 1. *Lingula hubbardi* Haynes, sp. nov.  $\times 2$ .  
 FIG. 2. *Meristella barrisi* Hall.  $\times 2$ .  
 FIG. 3. *Productella spinigera* Kindle.  $\times 2$ .  
 FIG. 4. *Orbiculoidea lodiensis* (Vanuxem).  $\times 2$ .  
 FIG. 5. *Productella coloradensis* Kindle.  $\times 2$ .  
 FIG. 6. *Schuchertella chemungensis* var. *arctostriata* (Hall).  $\times 2$ .  
 FIG. 7. *Productella coloradensis* Kindle.  $\times 2$ .  
 FIG. 8. *Productella coloradensis* Kindle. (Top view of specimen shown in Fig. 7.)  $\times 2$ .  
 FIG. 9. *Rhipidomella vanuxemi* Hall. (?).  $\times 2$ .  
 FIG. 10. *Rhipidomella vanuxemi* Hall. (Enlarged figure showing detail of surface of specimen given in Fig. 9.)  
 FIG. 11. *Leiorhynchus madisonense* Haynes, sp. nov.  $\times 2$ .  
 FIG. 12. *Leiorhynchus madisonense* Haynes, sp. nov. (Dorsal valve of specimen in Fig. 11.)  $\times 2$ .  
 FIG. 13. *Leiorhynchus madisonense* Haynes, sp. nov. (Ventral valve of smooth-sided form.)  $\times 2$ .  
 FIG. 14. *Leiorhynchus madisonense* Haynes, var. *gibbosum* Haynes, var. nov.  $\times \frac{3}{2}$ .  
 FIG. 15. *Leiorhynchus madisonense* Haynes, var. *gibbosum*. (Dorsal valve of specimen shown in Fig. 14.)  $\times \frac{3}{2}$ .  
 FIG. 16. *Leiorhynchus madisonense* Haynes, var. *gibbosum*, (Side view of same showing plications on side of shell.)  $\times \frac{3}{2}$ .



Brachiopods from Green Shales. (See opposite page.)

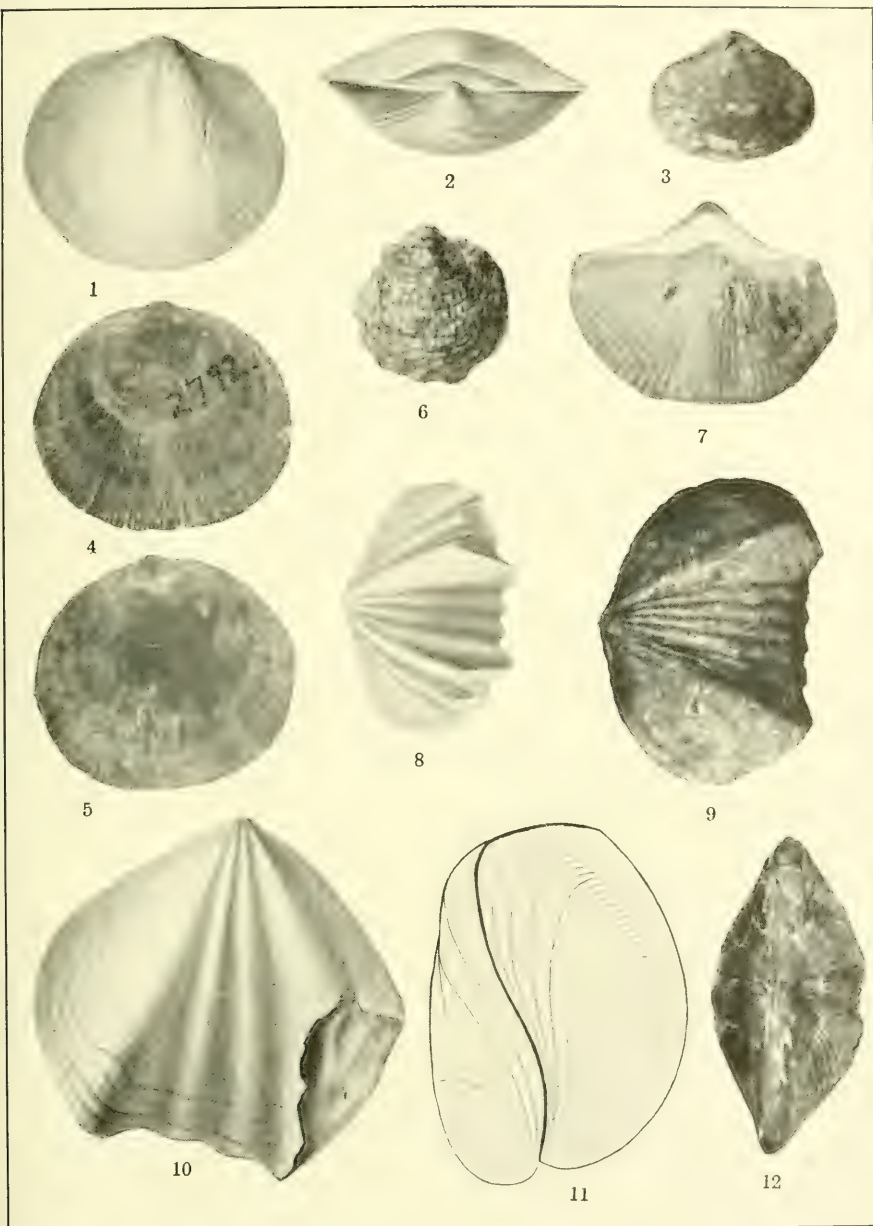






## EXPLANATION OF PLATE VIII.

- FIG. 1. *Schizophoria striatula*, var. *australis* Kindle.  $\times \frac{3}{2}$ .
- FIG. 2. *Schizophoria striatula*, var. *australis*. (Top view of specimen shown in Fig. 1.)  $\times \frac{3}{2}$ .
- FIG. 3. *Rhipidomella vanuxemi* Hall. (A small specimen showing area about umbo.)  $\times 2$ .
- FIG. 4. *Rhipidomella vanuxemi* Hall. Logan, Montana.  $\times 2$ .
- FIG. 5. *Rhipidomella vanuxemi* Hall. Logan, Montana. (Same specimen as shown in Fig. 4.)  $\times 2$ .
- FIG. 6. *Productella laminata* Kindle. Three Forks, Montana. Coll. Haynes.  $\times 2$ .
- FIG. 7. *Spirifer disjunctus* Sowerby = *S. verneuili* Murchison. Boulonnais Duval Coll. (To be compared with *S. whitneyi* Hall.)  $\times 2$ .
- FIG. 8. *Leiorhynchus dunbarens* Haynes, sp. nov. Holotype, Carn. Museum, Three Forks, Montana. Coll. P. E. Raymond.  $\times \frac{3}{2}$ .
- FIG. 9. *Leiorhynchus jeffersonensis* Haynes, sp. nov.  $\times 1$ .
- FIG. 10. *Leiorhynchus utahensis* Kindle, var. *ventricosum* Haynes, var. nov.  $\times 2$ .
- FIG. 11. *Leiorhynchus utahensis* Kindle, var. *ventricosum* Haynes. (Side view, inverted.)  $\times 2$ .
- FIG. 12. *Spirifer disjunctus* Sowerby. Try près Walfour. (To be compared with *S. whitneyi* var. *gallatinensis* Haynes.)  $\times 2$ .



Brachiopods from Green Shales. (See opposite page.)



### III. DESCRIPTION OF A NEW SPHAGEBRANCHUS FROM THE BAHAMAS.

(PLATE IX.)

BY C. H. EIGENMANN.

The genus *Sphagebranchus* is characterized by the absence of all fins and the small inferior gill-slits. Snout very sharply pointed, mouth large, horizontal, inferior, the lower jaw sharply pointed; gular region somewhat expanded, and with longitudinal grooves; gills large, gill-slits small, converging forward along the inner edge of a pair of comma-shaped depressions, the bottom of the depressions with a thin membrane; nostril inferior, not completely divided into anterior and posterior; lateral-line pores prominent. About twenty-three recurved teeth in the lower jaw, about twenty-seven similar teeth in a compact row along each side of the upper jaw, those in front smallest, four similar, but much larger, teeth on the snout in front of the regular series; about ten recurved teeth on a median line in the roof of the mouth. No tongue.

#### *Sphagebranchus conklini* sp. nov.

6710, C. M. Type, 235 mm. From coarse sand in ten feet of water, just inside the bar at entrance to harbor, New Providence, Bahamas, April 27, 1907. Collector, E. G. Conklin.

Tip of snout to anus 88 mm., to gill-opening 18; tail 147 mm.; gape of mouth 4 mm.; snout to eye 3.3 mm.; eye .66 mm.; width of body 4 mm. Over 110 pores in the lateral line; eye covered, but visible, the pupil a horizontal slit.

This species is evidently related to *S. anguiformis* Peters, the type of which was taken in the open Atlantic  $15^{\circ} 40' 1''$  north,  $23^{\circ} 5' 8''$  west. The location of Nassau is  $25^{\circ} 5' 6''$  north and  $77^{\circ} 21' 2''$  west. The differences may be tabulated as follows:

*S. conklini.*

Head and trunk 1.67 in length  
of tail.

Head to gill-openings 4 in the  
trunk, 13 in the total length.

Eye 5 in the snout.

Flesh color.

*S. anguiformis.*

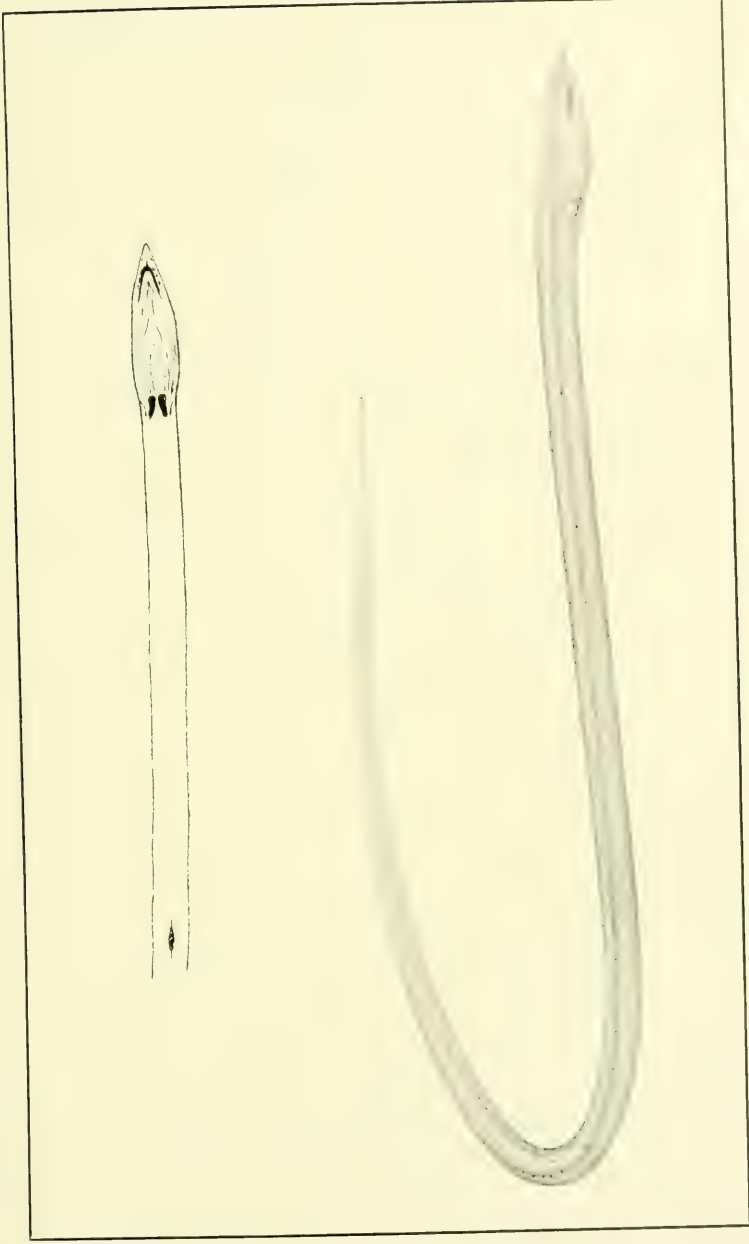
Head and trunk less than 1.5  
in length of tail.

Head 6 in the trunk, 17 in the  
total length.

Flesh color with minute dark  
spots.

After being caught this specimen was observed to rapidly make its way through the sand, which had been brought up by the dredge. It was presented to the Carnegie Museum by Professor E. G. Conklin of Princeton University.





*Sphagebranchius conklini* Eigenmann. Type, Nassau Harbor. Drawn from life by Dr. A. G. Mayer.  $\times 1$ .



#### IV. SOME MARINE FISHES FROM COLOMBIA AND ECUADOR.\*

BY CHARLES WILSON.

The specimens enumerated in the present paper were collected (*a*) by C. H. Eigenmann in January of 1912 in the bay and on the shores of the Caribbean Sea at Cartagena, and in March, 1912, at Buenaventura on the Pacific shores of Colombia; (*b*) by Arthur Henn and Charles Wilson in January, 1913, at Tumaco and in the Rio Rosario, both near the southwestern corner of Colombia; and (*c*) by Arthur Henn in May, 1913, at Guayaquil, Ecuador.

The primary object of the expeditions to Colombia and Ecuador was to collect freshwater fishes. No attempt was made to make complete collections of marine fishes at any of the localities which were visited.

The work of Professor Eigenmann was under the auspices of the Indiana University and the Carnegie Museum. The types and first series collected by him are in the Carnegie Museum. The work of Mr. Henn and myself in Colombia was under the auspices of the Indiana University and was equipped and financed by Mr. H. McK. Landon and Mr. Carl G. Fisher, both of Indianapolis. The types and first series collected by us are in the collections of the Carnegie Museum, which has engaged to publish the results of these expeditions. The second series obtained by the above expeditions are in the Museum of Indiana University.

The work of Mr. Arthur Henn in Ecuador and in the lower San Juan was under the auspices of Indiana University and was financed by Mr. Hugh McK. Landon of Indianapolis. The types and first series collected by him are, for the most part, in the collections of the Indiana University, the second series is in the Carnegie Museum.

A few of the marine fishes collected by Mr. Max Ellis during the Gimbel expedition to Guiana and by Mr. John Haseman for the Carnegie Museum are also listed.

In the following list of species and specimens the numbers refer

\* Contribution from the Zoological Laboratory of Indiana University, No. 149.

to the Catalog of Fishes of the Carnegie Museum (C. M.) and to that of Indiana University Museum (I. U. M.).

Family GALEIDÆ.

1. **Charcharhinus cerdale** (Gilbert).

5670 *a*, C. M.; 13508 *a*, I. U. M. Market of Guayaquil, Ecuador, May, 1913. Arthur Henn.

5671 *a*, C. M.; 13509 *a*, I. U. M. Buenaventura, Colombia. Eigenmann.

Family SPHYRNIDÆ.

2. **Sphyrna tiburo** (Linnæus).

5675 *a*, C. M.; 13514 *a*, I. U. M. Market in Guayaquil, Ecuador, May, 1913. Henn.

Family PRISTIDÆ.<sup>1</sup>

3. **Pristis pectinatus** Latham.

13512 *a*, I. U. M. Georgetown Harbor, British Guiana. Max M. Ellis.

4. **Pristis perrotteti** Valenciennes.

13513 *a*, I. U. M. Market of Guayaquil, Ecuador, May, 1913. Arthur Henn.

Family RHINOBATIDÆ.

5. **Rhinobatus leucorhynchus** Günther.

5674 *a*, C. M.; 13511 *a*, I. U. M. Tumaco, Colombia, Jan. 2, 1913. Henn & Wilson.

Family SILURIDÆ.

6. **Galeichthys simonsi** Starks.

5586 *a-f*, C. M.; 13218 *a-b*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

6721 *a-b*, C. M., 220-265 mm. Buenaventura. Eigenmann.

5663 *a-b*, C. M.; 13223 *a-b*, I. U. M. Tumaco, Colombia, Jan. 2, 1913. Henn & Wilson.

5664 *a*, C. M.; 13224 *a*, I. U. M. Rio Rosario, Colombia. Henn.

5665 *a*, C. M.; 13225, I. U. M. Buenaventura, Colombia. Eigenmann.

<sup>1</sup> A species of *Pristis* is abundant both in the Atrato and in the San Juan Rivers.

## Genus FELICHTHYS Swainson.

This marine genus is composed of four species, two of which occur in the Pacific and two in the Atlantic. We have the two Pacific species, *F. panamensis* and *F. pinnimaculatus* from Buenaventura, and *F. pinnimaculatus*, from Guayaquil.

- a.* Dorsal spine not produced in a long filament, occipital process large and shaped like a clover-leaf, anal with dark margin. Head 3.66-4.25; depth 4.66-5.5; D. 1, 7; A. 28 to 30. . . . . *panamensis* Gill.  
*aa.* Dorsal spine produced in a long filament, occipital process normal; anal with a large dark blotch on the anterior lobe. Head 4-4.75; depth 4-4.8; D. 1, 7; A. 28 to 30. . . . . *pinnimaculatus* Steindachner.

7. *Felichthys pinnimaculatus* (Steindachner).

*Ælurichthys pinnimaculatus* STEINDACHNER, Sitzber. Akad. Wiss. Wien, LXXIV, Ichthyol. Beitr., IV, 1875, p. 15, pl. VIII, figs. 1-3 (Panama); JORDAN & GILBERT, Bull. U. S. Fish Comm., 1882, p. 34 (Panama); Proc. U. S. Nat. Mus., 1882, p. 662 (Panama); EIGENMANN & EIGENMANN, Proc. Cal. Acad. Sci., 2d ser., Vol. I, 1888, p. 148 (Panama); South American Nematognathis, 1890, p. 35 (Panama).

*Felichthys pinnimaculatus* GILBERT & STARKS, Mem. Cal. Acad. Sci., Vol. IV, 1904, p. 20 (Panama); JORDAN & EVERMANN, Bull. U. S. Nat. Mus., No. 47, Vol. 1, 1896, p. 117.

6680 *a*, C. M., 453 mm. Guayaquil. Henn. 13553, I. U. M., 245 mm. Buenaventura. Eigenmann.

8. *Felichthys panamensis* (Gill).

6679 *a*, C. M., 305 mm. Buenaventura. Eigenmann.

9. *Sciadeichthys troscheli* (Gill).

6723 *a-e*, C. M., 210-240 mm.; 13554, I. U. M., 195-260. Tumaco. Henn.

10. *Netuma kessleri* (Steindachner).

6722 *a*, C. M., 245 mm. Buenaventura. Eigenmann.

## Family SYNODONTIDÆ.

11. *Synodus scituliceps* Jordan & Gilbert.

5669 *a-c*, C. M.; 13506 *a-c*, I. U. M. Tumaco, Colombia, Jan. 2, 1913, Henn & Wilson; 13507 *a*, I. U. M., Guayaquil market, Henn.

The specimens from Tumaco and Guayaquil market agree with *S. jenkinsi* Jordan & Bollman, which Gilbert and Starks (California.



Academy of Sciences, Vol. IV, p. 50) consider synonymous with *S. scituliceps* Jordan & Gilbert.

Family HEMIRAMPHIDÆ.

12. **Hyporhamphus roberti** (Cuvier & Valenciennes).

13503 *a*, I. U. M. Market of Guayaquil, Ecuador. May, 1913. Henn.

Family SYNGNATHIDÆ.

13. **Hippocampus punctulatus** Guichenot.

5653 *a*, C. M.; 13430 *a*, I. U. M. Cartagena, Colombia. Eigenmann.

14. **Siphostoma rousseau** (Kaup).

5673 *a*, C. M.; 13510, I. U. M. Cartagena, Colombia. Eigenmann.

15. **Siphostoma eigenmanni** Wilson, sp. nov.

5672 *a*, C. M. **Type** 121 mm. Rio Vermelho, Bahia. Oct. 24, 1907. J. D. Haseman.

Body-rings eighteen, caudal rings twenty-eight, dorsal rays forty-five, commencing before the vent and extending on one-and-a-half plus seven rings. Snout slender and compressed; its length is contained one and five-eighths times in total length of head. Diameter of eye contained five and one-half times in length of snout and eight and one-fifth times in total length of head. Space from the anterior border of the orbit of eye to the posterior border of the opercle is contained one and five-eighth times in the length of snout. Head is contained in total length, including caudal, five and three-fourths times. Depth of body before dorsal is contained two times in the space between the posterior border of the opercle and the anterior border of the orbit of the eye. Distance from vent to tip of caudal is contained in the distance from vent to tip of snout one and seven-hundredths times. Keels sharp and high; each body-ring bearing two ventral, two lateral, and two dorsal keels. Lateral line interrupted above the vent. Five radiating ridges pass from the anterior border of the opercle backward and downward. The uppermost dorsal ridge passes ventral to the blotches. The three central ridges are visible without lens. The upper two-thirds of the opercle covered with brown blotches. A brown line commences on the anterior ventral border of the snout and passes backward and laterally through the eye and along the dorsal border

of the opercle and is continued as a broken line to its termination above the vent. Center of caudal rays dark. A brown line on ventral surface extends from vent to head. Color in alcohol pale, with brown blotches on the sides of each ring.

Family MUGILIDÆ.

16. **Mugil cephalus** Linnaeus.

5244 *a-c*, C. M., 13204 *a-e*, I. U. M. Eighteen duplicates. Tumaco, Colombia. Henn & Wilson.

5644, C. M. Barra de Penedo. Mouth of Rio San Francisco. J. D. Haseman.

17. **Mugil brasiliensis** Agassiz.

5245 *a-b*, C. M., 13205, I. U. M. Cartagena, Colombia. Eigenmann.

18. **Mugil curema** Cuvier & Valenciennes.

5642 *a*, C. M. Cachoeira. April 17, 1908. J. D. Haseman.

5643 *a*, C. M.; 13429 *a-b*, I. U. M. Chone, Province Manabi, Ecuador. Henn.

The specimens from Ecuador examined agree with the description of *M. gaimardianus* Desmarest, but Regan in the *Biologia Centrali-Americana, Pisces*, p. 72, considers the difference between *M. curema* and *M. gaimardianus* to be due merely to individual variation.

Family POLYNEMIDÆ.

19. **Polydactylus approximans** (Lay & Bennett).

5576 *a*, C. M.; 13207 *a*, I. U. M. Buenaventura. Eigenmann.

20. **Polydactylus virginicus** (Linnaeus).

5583 *a-h*, C. M.; 13208 *a-d*, I. U. M. Cartagena. Eigenmann.

5263 *a*, C. M. Cachoeira. April 17, 1908. J. D. Haseman.

5264 *a*, C. M. Rio Vermelho, Bahia. Oct. 24, 1907. J. D. Haseman.

Family HOLOCENTRIDÆ.

21. **Holocentrus ascensionis** (Osbeck).

5575 *a-b*, C. M.; 13212 *a*, I. U. M. Cartagena. Eigenmann.

Family MULLIDÆ.

22. **Upeneus grandisquamis** Gill.

5581 *a-b*, C. M.; 13206 *a*, I. U. M. Tumaco. Henn & Wilson.

## Family CARANGIDÆ.

23. *Oligoplites refulgens* Gilbert & Starks.

5652 *a*, C. M.; 13436 *a*, I. U. M. Market of Guayaquil, Ecuador.  
Henn.

24. *Oligoplites mundus* Jordan & Starks.

5655 *a-c*, C. M.; 13439 *a-c*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

5656 *a-d*, C. M.; 13440 *a-d*, I. U. M. Market of Guayaquil, Ecuador.  
Henn.

5659 *a-b*, C. M.; 13443 *a*, I. U. M. West Bank, Georgetown Harbor,  
British Guiana. Max M. Ellis.

25. *Oligoplites altus* (Günther).

5657 *a-b*, C. M.; 13441 *a-b*, I. U. M. Market of Guayaquil, Ecuador.  
Henn.

13445 *a*, I. U. M. Rio Rosario, Colombia. Henn & Wilson.

26. *Oligoplites saurus* (Bloch & Schneider).

5658 *a-e*, C. M.; 13442 *a-e*, I. U. M. Cartagena, Colombia. Eigenmann.

27. *Caranx hippos* (Linnaeus).

5650 *a*, C. M.; 13434 *a*, I. U. M. Market of Guayaquil, Ecuador.  
Henn.

5660 *a*, C. M. Cartagena, Colombia. Eigenmann.

28. *Caranx caballus* (Günther).

13435 *a*, I. U. M. Tumaco, Colombia. Henn & Wilson.

29. *Trachinotus fasciatus* Gill.

13209 *a*, I. U. M. Tumaco, Colombia. Henn & Wilson.

30. *Trachinotus culveri* Jordan & Starks.

5661 *a-f*, C. M.; 13444 *a-e*, I. U. M. Cartagena, Colombia. Eigenmann.

31. *Trachinotus glaucus* (Bloch).

5662 *a*, C. M. Cartagena, Colombia. Eigenmann.

32. *Selene vomer* (Linnaeus).

13239 *a*, I. U. M. Tumaco, Colombia. Jan. 2, 1913. Henn & Wilson.

33. *Vomer setipinnis* (Mitchill).

5265 *a*, C. M.; 13240 *a*, I. U. M. Tumaco, Colombia. Jan. 2, 1913.  
Henn & Wilson.

## Family CENTROPOMIDÆ.

34. *Centropomus pectinatus* Poey.

5256 *a-c*, C. M.; 13232 *a-d*, I. U. M. Cartagena, Colombia. Eigenmann.

5258 *a*, C. M.; 13233 *a-b*, I. U. M. Buenaventura, Colombia. Eigenmann.

5252 *a-g*, C. M. Rio Vermelho, Bahia. Oct. 24, 1907. J. D. Haseman.

35. *Centropomus grandoculatus* Jenkins & Evermann.

5257 *a*, C. M.; 13234 *a-b*, I. U. M. Mouth of Rio Dagua, Buenaventura. Eigenmann.

D. vii, i. 10, A. iii, 7. Scales 8-54 to 56-13, before first dorsal 25. Specimens 4022 and 7743, I. U. M., have D. vii, i. 10. A. iii, 7. Scales 8-54-13, number scales before first dorsal (4022, I. U. M.) 24 and (7743, I. U. M.) 26.

Gilbert & Starks (California Academy of Sciences, Vol. IV, p. 90), say: "*C. grandoculatus* is certainly not separable from *C. medius* Günther, or from *C. pedimacula* Poey. The describers of *grandoculatus* seem to have neglected the first spine, which is very short and often concealed by scales. The first dorsal contains eight spines as in all other species of the genus."

Regan (*Biologia Centrali-Americana*, p. 47) considers *C. grandoculatus* and *C. medius* Günther as the same species.

Günther (*Fishes of Central America*, Trans. Zoöl. Soc. Lond. Vol. VI, 1868, p. 406), describes *C. medius* as having: "D.  $8 \left| \frac{1}{10} \right.$ ; A.  $\frac{3}{7}$ ; L. lat. 57."

Jordan & Evermann (Bulletin U. S. National Mus., No. 47, Part I, p. 1120) described *C. grandoculatus* as having D. vii-i, 10; A. iii, 7; scales 8-52 to 54-13, 23 to 26 before dorsal.

I consider *C. grandoculatus* Jenkins & Evermann to be a distinct species. Specimens 4022 and 7743 have only seven spines in the first dorsal. The specimens collected at Buenaventura, Colombia, have only seven spines in the first dorsal. The specimens examined by

Gilbert & Starks were evidently *C. medius* Günther, and not *C. grandoculatus* Jenkins & Evermann.

36. *Centropomus parallelus* Poey.

5251 *a*, C. M. Barbados, B. W. I. Eigenmann.

37. *Centropomus undecimalis* Bloch.

5255 *a-b*, C. M.; 13231 *a-b*, I. U. M. Cartagena, Colombia. Eigenmann.

38. *Centropomus viridis* Lockington.

5254 *a-b*, C. M.; 13230 *a*, I. U. M. Market of Guayaquil, Ecuador. Henn.

39. *Centropomus nigrescens* Günther.

5250 *a*, C. M.; 13229 *a-b*, I. U. M. Market of Guayaquil. Henn.

40. *Centropomus ensiferus* Poey.

5253 *a*, C. M. Cachoeira, Brazil. April 17, 1908. J. D. Haseman.

41. *Centropomus armatus* Gill.

5243 *a-b*, C. M.; 13226 *a-c*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

5248 *a*, C. M.; 13227 *a-b*, I. U. M. Puerto Negria, Colombia. Eigenmann.

5249 *a*, C. M.; 13228 *a-b*, I. U. M. Rio Rosario, Colombia. Henn & Wilson.

Family SERRANIDÆ.

42. *Epinephelus maculosus* (Cuvier & Valenciennes).

5641 *a*, C. M. Cartagena, Colombia. Eigenmann.

Family LUTIANIDÆ.

43. *Neomænis griseus* (Linnæus).

5259 *a-c*, C. M.; 13235 *a-g*, I. U. M. Nine duplicates. Cartagena, Colombia. Eigenmann.

44. *Neomænis apodus* (Walbaum).

5574 *a-e*, C. M.; 13216 *a-b*, I. U. M. Three duplicates. Cartagena, Colombia. Eigenmann.

13215 *a*, I. U. M. Tumaco, Colombia. Henn & Wilson.



45. *Neomænis argentiventris* (Peters).

5579 *a*, C. M.; 13213 *a*, I. U. M. Buenaventura, Colombia. Eigenmann.

46. *Neomænis analis* (Cuvier & Valenciennes).

5582 *a-j*, C. M., 13214 *a-c*, I. U. M. Cartagena, Colombia. Eigenmann.

47. *Neomænis mahogoni* (Cuvier & Valenciennes).

5573 *a-d*, C. M.; 13217 *a-c*, I. U. M. Cartagena, Colombia. Eigenmann.

48. *Neomænis aratus* (Günther).

5260 *a-b*, C. M.; 13236 *a-c*, I. U. M. Tumaco, Colombia. Jan. 2, 1913. Henn & Wilson.

In young specimens I find the scales in the lateral line to be from forty-five to fifty; soft rays in dorsal twelve to fourteen; soft rays in anal seven to nine; interorbital area broad, width four to five times in head.

49. *Ocyurus chrysurus* (Bloch).

5261 *a-b*, C. M.; 13237 *a-b*, I. U. M. Cartagena, Colombia. Eigenmann.

## Family HÆMULIDÆ.

50. *Hæmulon plumieri* (Lacépède).

5578 *a-d*, C. M.; 13219 *a-c*, I. U. M. Cartagena. Eigenmann.

5577 *a*, C. M.; 13220 *a*, I. U. M. Soplaviento. Eigenmann.

51. *Hæmulon macrostomum* Günther.

5585, eight specimens, C. M.; 13222 *a-c*, I. U. M. Cartagena, Colombia. Eigenmann.

52. *Hæmulon scudderi* Gill.

5262 *a*, C. M.; 13238<sup>7</sup>*a*, I. U. M. Guayaquil Market. Henn.

53. *Hæmulon parra* (Desmarest).

5267 *a-c*, C. M., 13243 *a-b*, I. U. M. Cartagena, Colombia. Eigenmann.

54. *Hæmulon sciurus* (Shaw).

13221 *a*, I. U. M. Cartagena, Colombia. Eigenmann.

## Family POMADASIDÆ.

55. *Pomadasis macracanthus* (Günther).

5651 *a*, C. M.; 13243 *a*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

56. *Pomadasis branicki* (Steindachner).

5266 *a-b*, C. M.; 13241 *a*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

## Family SPARIDÆ.

57. *Archosargus unimaculatus* (Bloch).

5648 *a-h*, C. M.; 13433 *a-d*, I. U. M. Cartagena, Colombia. Eigenmann.

58. *Calamus brachysomus* (Lockington).

5649 *a*, C. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

## Family GERRIDÆ.

59. *Gerres simillimus* Regan.

5268 *a*, C. M.; 13437 *a-b*, I. U. M. Market of Guayaquil, Ecuador. Henn.

60. *Gerres cinereus* (Walbaum).

5269 *a-o*, C. M.; 13244 *a-f*, I. U. M. Cartagena, Colombia. Eigenmann.

61. *Gerres rhombeus* Cuvier & Valenciennes.

5270 *a*, C. M. Cachoeira, April 17, 1908. Haseman.

62. *Gerres lineatus* (Humboldt).

5274 *a-f*, C. M.; 13248 *a-f*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

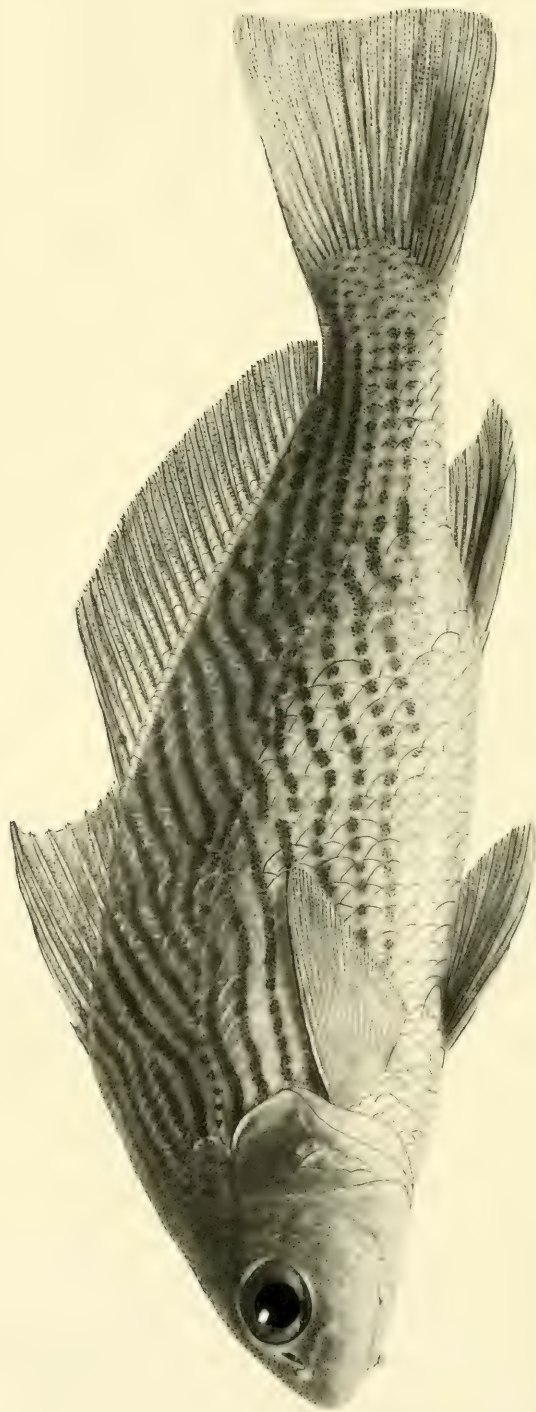
5273 *a*, C. M.; 13247 *a-b*, I. U. M. Tumaco, Colombia. Jan. 2, 1913. Henn & Wilson.

63. *Gerres aureolus* Jordan & Gilbert.

13249 *a*, I. U. M. Rio Rosario, Colombia. Henn & Wilson.

5375 *a-f*, C. M., 13250 *a-f*, I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia, Eigenmann.





*Umbrina tumacocensis* Wilson. Type. 5654 a, C. M. 163 mm. Tumaco.

64. *Gerres olisthostomus* Goode & Bean.

5276 *a-b*, C. M.; 13426 *a-b*, I. U. M. Cartagena, Colombia. Eigenmann.

65. *Gerres patao* Poey.

5272 *a*, C. M.; 13246 *a*, I. U. M. Cartagena, Colombia. Eigenmann.

66. *Eucinostomus pseudogula* Poey.

5241, C. M.; 13201 *a-d*, I. U. M, fifteen duplicates. Cartagena, Colombia. Eigenmann.

5584, thirty-two specimens, C. M., 13203 *a-h*, I. U. M. Tumaco, Colombia, Jan. 2, 1913. Henn & Wilson.

67. *Eucinostomus gula* (Cuvier & Valenciennes).

5242 *a-e*, C. M.; 13202 *a-e*, I. U. M. Forty-seven duplicates. Cartagena, Colombia. Eigenmann.

68. *Eucinostomus californiensis* (Gill).

5271 *a-c*, C. M.; 13245 *a-f*, I. U. M. Guayaquil Market. Henn.

## Family SCIÆNIDÆ.

69. *Umbrina tumacoënsis* Wilson, sp. nov. (Plate X.)

5654 *a*, C. M. **Type**, 163 mm. **Paratypes** 90-121 mm. 5654 *b-c*, C. M.; 13438 *a-b*, I. U. M. Tumaco, Colombia. Henn & Wilson.

D. x, i, 24; A. ii, 6; scales in lateral line 50-52. Length of head three and one-half times in total length, including caudal. The height of the body is contained three and one-half times in the total length without caudal. Snout produced beyond the mouth. Diameter of eye is contained four times in head, and one and one-half times in snout.

Symphyseal barbel short, scarcely longer than posterior nostril. Preoperculum distinctly serrated; the serræ slightly enlarged at the angle. The second and third spines of first dorsal fin subequal, contained one and one-half times in the length of head. Color dark above, silvery below; a dark blotch on the opercle; dark olive stripes follow the centers of the scale-rows upward and backward on the sides and back; spinous dorsal and anal dusky; ventrals with punctulations; gill-membrane and peritoneum pale. Maxillary extending to center of pupil.



## Family LABRIDÆ.

70. *Iridio bivittatus* (Bloch).

5278 *a*, C. M. Cartagena, Colombia. Eigenmann.

71. *Iridio bimaculata* sp. nov.

5280 *a*, C. M. **Type**, 170 mm. **Paratype**, 5280 *b*, C. M. 112 mm. 13428 *a*, **Paratype** 164 mm., I. U. M. Mouth of Rio Dagua, Buenaventura, Colombia. Eigenmann.

D. IX, 11; A. III, 12. Scales 3-27-10. Length of head contained three times in total length, not including the caudal. Width contained three and one-half times in total length, not including the caudal. Diameter of eye contained in length of head six and one-half times. Anterior canines in lower jaw subequal. Dorsal spines slender. First anal spine much reduced. Caudal rounded. Ventrals not reaching vent, but extending beyond the vertical from hind margins of pectorals. Lateral line continuous; the posterior portion running on the third series below the anterior portion. A spot on soft dorsal extending from behind the second ray to the fourth ray. A spot at the base of caudal equal to two-thirds the diameter of eye. Above grayish olive; below pale.

## Family SCARIDÆ.

72. *Scarus croicensis* (Bloch).

5279 *a-f*, C. M.; 13427 *a-d*, I. U. M. Cartagena, Colombia. Eigenmann.

## Family BALISTIDÆ.

73. *Balistes polylepis* Steindachner.

5646 *a*, C. M.; 13431 *a*, I. U. M. Tumaco, Colombia, Jan. 2, 1913. Henn & Wilson.

74. *Balistes naufragium* Jordan & Starks.

5647 *a*, C. M.; 13432 *a*, I. U. M. Market of Guayaquil, Ecuador. Henn.

## Family MONACANTHIDÆ.

75. *Monacanthus oppositus* Poey.

5277 *a*, C. M. Cartagena, Colombia. Eigenmann.

Family TETRAODONTIDÆ.

76. *Spheroides annulatus* (Jenyns).

- 5246 *a-b*, duplicates C. M.; 13210 *a-b*, I. U. M. Tumaco, Jan. 2, 1913.  
Henn & Wilson.  
5247 *a*, C. M. Rio Rosario. Henn & Wilson.

77. *Spheroides testudineus* (Linnæus).

- 5580, C. M., 13211 *a-e*, I. U. M. Thirty six specimens. Cartagena,  
Colombia. Eigenmann.  
5666 *a*, C. M. Barra de Penedo. April 8, 1908. J. D. Haseman.

Family GOBIIDÆ.

78. *Philypnus maculatus* (Günther).

- 5680 *a-c*, C. M.; 13518 *a-c*, I. U. M. Market of Guayaquil, Ecuador.  
May, 1913. Henn.  
13519 *a*, I. U. M. Rio San Juan at Mouth of Rio Cucurupi, Colombia.  
Henn.

79. *Philypnus dormitor* (Lacépède).

- 5687 *a*, C. M. Rio Vermelho, Bahia. Oct. 24, 1907. J. D. Haseman.

80. *Eleotris picta* Kner and Steindachner.

- 5681 *a-b*, C. M.; 13520 *a-b*, I. U. M. Market of Guayaquil, Ecuador.  
May, 1913. Henn.  
5682 *a*, C. M.; 13521 *a-b*, I. U. M. Chone, Province of Manabi,  
Ecuador. Henn.

81. *Dormitator maculatus* (Bloch).

- 5679 *a*, C. M. Cartagena, Colombia. Eigenmann.

82. *Dormitator latifrons* Richards.

- 5676 *a-d*, C. M.; 13515 *a-d*, I. U. M. Fifteen duplicates. Market of  
Guayaquil, Ecuador. May, 1913. Henn.  
5677 *a-d*, C. M.; 13516 *a-d*, I. U. M. Eight duplicates. Chone,  
Province of Manabi, Ecuador. Henn.  
5678 *a-b*, C. M.; 13517 *a-b*, I. U. M. Mouth of Rio Dagua, Buena-  
ventura, Colombia. Eigenmann.

83. **Gobius soporator** Cuvier & Valenciennes.

- 5683 *a*, C. M.; 13522 *a*, I. U. M. Tumaco, Colombia. Jan. 2, 1913.  
Henn & Wilson.
- 5684 *a-b*, C. M.; 13523 *a-b*, I. U. M. Cartagena, Colombia, Eigenmann.
- 5686 *a-d*, C. M.; 13524 *a-d*, I. U. M. Market of Guayaquil, Ecuador.  
May, 1913. Henn.
- 5685 *a-d*, C. M. Rio Vermelho, Bahia. Oct. 24, 1907, J. D. Haseman.

## Family PLEURONECTIDÆ.

84. **Citharichthys gilberti** Jenkins & Evermann.

- 5667 *a-f*, C. M.; 13504 *a-f*, I. U. M. Market of Quayaquil, Ecuador.  
May, 1913. Henn.
- 5668 *a*, C. M.; 13505 *a-b*, I. U. M. Tumaco, Colombia. Jan. 2,  
1913. Henn & Wilson.

V. ON APAREIODON, A NEW GENUS OF CHARACID  
FISHES.\*

BY CARL H. EIGENMANN.

(PLATES XI-XII.)

*Apareiodon*<sup>1</sup> is in all respects like *Parodon* except that there are no teeth in the side of the lower jaw. The ampulla on the upturned edge of the lower jaw, with which the teeth are associated in *Parodon*, is less well-developed in this genus.

*Distribution*.—Western Panama and Ecuador, Rio San Francisco, La Plata.

**Type:** *Parodon piracicabæ* Eigenmann.

KEY TO THE SPECIES OF APAREIODON.

- a. Mouth distinctly inferior.
  - b. A dark streak along the lateral line and a second one above the first or second row of scales above it.
    - c. Head 5; lateral line 41 or 42; interorbital 3, or less than 3, in the length of the head.....1. *piracicabæ* (Eigenmann).
    - cc. Head 4.5; lateral line 35 or 36; interorbital 3 in the length of the head.....2. *itapicuruensis* Eigenmann & Henn.
  - bb. A dark streak along the lateral line and dark shades across the back, at least in the adult.
    - d. Lateral band continuous.
      - e. Two teeth in the maxillary; lateral line 40-44; predorsal scales 12-14; eye 4 in the head, interorbital less than 3.
        - 3. *affinis* (Steindachner).
      - ee. One tooth in the maxillary; lateral line usually 37 (41 in one specimen); predorsal scales 10-12, usually 11.
        - 4. *hasemanni* Eigenmann.
    - dd. Three broken stripes; dorsal and caudal lobes with cross-bands.
      - 5. *dariensis* Meek & Hildebrand.
    - ddd. Lateral band moniliform; one maxillary tooth; lateral line 37; predorsal scales 11-12.....6. *ecuadoriensis* (Eigenmann & Henn).
  - aa. Mouth terminal; a simple lateral band...7. *terminalis* (Eigenmann & Henn).

1. *Apareiodon piracicabæ* (Eigenmann).

*Parodon affinis* EIGENMANN & NORRIS (*non* STEINDACHNER), Revista Museu Paulista, Vol. IV, 1900, p. 356.

\* Contribution from the Zoological Laboratory of Indiana University, No. 143.

<sup>1</sup> α privative, *παρειά* = the cheek. *ὀδών*, = tooth; *Apareiodon* = without teeth in the cheeks, or side of the mouth.

*Parodon piracicabæ* EIGENMANN, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 6, (Piracicaba, Province São Paulo, Brazil); Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 423.

*Habitat*.—Basin of the Tieté.

9292 *a-c*, I. U. M. 112–127 mm. Piracicaba, von Ihering. **Types.**

6588 *a*, C. M. 150 mm. Piracicaba, July 23, 1908. Haseman.

5705 *a-e*, C. M. 61–125 mm. Salto Avanhandava, above the falls. Sept. 14, 1908. Haseman.

12660 *a*, I. U. M. 93 mm. Puerto Bertoni, Alto Paraná. Bertoni.

Head 5 (4.5 in the smallest); depth 4.33–4.75; D. 10–12; A. 8.1; P. 14; scales 4–40 to 43–3; eye 3.6–4 in the head, snout about 3, equal to interorbital; depth of caudal peduncle equals one-half the depth at the dorsal.

Dorsal and ventral profiles about equally arched. Four premaxillary and two maxillary teeth; origin of dorsal about equidistant from snout and middle of adipose or some point behind the adipose in the young, highest dorsal ray about equal to head less half the opercle, its margin obliquely truncate, the longest ray scarcely projecting beyond tip of last ray; end of anal about on vertical from origin of adipose in adult; height of anal a little greater or a little less than length of head.

A dark stripe from tip of snout along lateral line to end of middle caudal rays, obscure on head, well marked on sides; a second band, narrower and less intense between first and second scale below dorsal from occiput to adipose dorsal; a silvery band below the lateral band; one to three dusky spots along the middle of the back in front of the dorsal, usually obscure or absent in the adult; dark shades across the back just in front of the adipose, between dorsal and adipose, at the dorsal, and at the nape, a partial band confined to the sides between the bands at the dorsal and at the nape. These cross-shades are well marked in some of the young, very obscure or absent in the adult.

2. *Apareiodon itapicuruiensis* Eigenmann & Henn. (Plate XI, fig. 2.)

5804 *a*, C. M. **Type.** 78 mm. Rio Paiaia, tributary of Rio Itapicurú. Nov. 8, 1907. Haseman.

5805 *a-c*, C. M. **Paratypes**, 62–72 mm. Same place and date.

5806 *a-e*, C. M.; 13542 *a-c*, I. U. M. **Paratypes**, 46–66 mm. Queimadas, Rio Itapicurú, March 2, 1908. Haseman.



5807 *a-m*, C. M. (Young) 24-43 mm. Same lot as 5806, C. M. Haseman.

5808 *a*, C. M. 26 mm. Timbo, Rio Itapicurú, March 5, 1908. Haseman.

5809 *a*, C. M. 48 mm. Rio Aqua Branca, Nov. 6, 1907. Haseman.

Closely related to *A. piracicabæ* (Eigenmann), differing in the slightly larger scales, longer head, and in coloration.

Head 4-4.5; depth 4-4.5; D. 11, rarely 12; A. 8, the first ray, a mere rudiment; scales 4-35 or 36-3. Eye 1.25 in snout, 3.5 in head; snout equal to interorbital, which is 3 in the head. Occipital process bluntly rounded, bordered by two or three scales; no fontanels. A regular median predorsal series of ten or eleven scales.

Dorsal profile gently curved, ventral profile flattened, horizontal or curved. Depth of caudal peduncle about half the depth at dorsal. Snout conical; mouth inferior; four slender multicuspid premaxillary teeth, two minute maxillary teeth, no mandibular teeth.

Origin of the dorsal equidistant from the tip of the snout and a point four or five scales behind the adipose, its height equal to the head less half the opercle. End of anal on, or slightly in advance of, the vertical from the adipose, its height equal to the snout and eye. Ventrals overlap the anus, their origin equidistant from the tip of the snout and the tips of the middle rays of the caudal. Caudal forked, the lobes rounded, their length somewhat less than the head.

Upper border of snout margined with brownish; a broad band of the same color extends from the upper angle of the opercles along the lateral line to the tips of the middle rays of the caudal. A narrower band extends above and parallel to this through the center of the third row of scales from above the eye to the base of the caudal. The space between these two bands and the ventral surface is whitish or silvery. Extending from the upper band across the dorsal ridge to the corresponding band of the other side is a series of broad vertical bands forming blotches; the first, midway between occiput and dorsal, another through the center of dorsal, and the last over the adipose. These often show through the clear space between the two lateral bands; others, midway between these, extend only over the dorsal ridge. All fins hyaline or colorless, except for faint markings at the base of both lobes of the caudal.

Young specimens (5807) have all the markings less distinct; the upper lateral stripe is especially late in making its appearance.

3. *Apareiodon affinis* (Steindachner). (Plate XI, fig. 1.)

*Parodon affinis* STEINDACHNER, Neue & Seltene Fisch-Arten, 1879, p. 20, pl. III, fig. 3 (La Plata); EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., Vol. XIV, 1891, p. 49; BERG, An. Mus. Nac. Buenos Aires, Vol. V, 1897, p. 279 (Rio de La Plata; Paraguay); BOULENGER, Trans. Zoöl. Soc. London, Vol. XIV, 1896, p. 34 (North Paraguay); Bull. Mus. Torino, Vol. XII, 1897 (Caiza; Mission de San Francisco). EIGENMANN, Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 423; EIGENMANN & KENNEDY, Proc. Acad. Nat. Sci. Phila., 1903, p. 512.

*Parodon paraguayensis* EIGENMANN, Proc. U. S. Nat. Mus., Vol. XXXIII, 1907, p. 6 (Asunción); Ann. Carnegie Mus., Vol. IV, 1907, p. 124, pl. XXXIX, fig. 1, 1907 (Asunción); Reports Princeton Univ. Exp. Patagonia, Vol. III, 1910, p. 423.

*Habitat*.—La Plata Basin.

6589 *a-d*, C. M. 128–138 mm. São João del Rei, Rio das Mortes, emptying into Rio Grande, this into Paraná. May 17, 1908. Haseman.

75706 *a-c*, C. M. 21–31 mm. Rio Parahyba bridge, Aug. 15, 1908. Haseman.

6591 *a-f*, C. M. 92–101 mm. Cacequy, Rio Ibicuhy, emptying into Rio Uruguay. Feb. 1 and 2, 1909. Haseman.

6590 *a-i*, C. M. 28–120 mm. Uruguayana, February 5, 1909. Hasemann.

6592 *a-b*, C. M. 91–106 mm. Asunción, March 29, 1909. Haseman.  
10237 *a-n*, I. U. M. 45–80 mm. Asunción. Anisits.

6594 *a*, C. M. Corumbá. April 27, 1909. Haseman.

6593 *a-k*, C. M. 87–112 mm. Villa Hayes. April 13, 1909. Haseman.

9953 *a-o*, I. U. M. 52–80 mm. Asunción, Paraguay. Anisits.

9952 *a-j*, I. U. M. 76–96 mm. Asunción, Paraguay. Anisits.

9975 *a-c*, I. U. M. Between 40 and 50 mm. Asunción, Paraguay. Anisits.

Head 3.5–4.5; depth 4.33–5.5; D. 11 or 12; A. 7 or 8; P. 12–14; scales  $4\frac{40}{2}$ ,  $\frac{41}{2}$ ,  $\frac{42}{3}$ ,  $\frac{43}{2}$ ,  $\frac{44}{12}$ ; 12 to 14 predorsal scales; eye 3.5–4 in the head, snout 3, about equal to interorbital; width of mandible 5–5.5 in the head.

Origin of dorsal equidistant from tip of snout and tip of adipose or a little farther back; height of dorsal equal to the portion of the head in front of upper angle of gill-opening; margin of dorsal obliquely truncate, the highest ray extending beyond tip of last; adipose fin over the anal.

A dark band from tip of snout along lateral line to tip of middle caudal rays, a silvery band below it; back with faint dark cross-shades, narrower and usually more numerous than in *piracicabæ*, one below tip of adipose, one in front of the adipose, two or three between adipose and dorsal, one or two below dorsal, one just in front of dorsal, one or two between dorsal and nape, and one at nape. Sometimes only one between dorsal and the one just in front of adipose, and but one between that under the dorsal and that at the nape. Some of the smaller specimens with only three cross-shades; at the adipose, under the dorsal, and at the nape. Sometimes the cross-shades in front of the dorsal are broken.

*Parodon affinis* was described by Steindachner as having two teeth on the side of each mandible. I have examined the types in the Vienna Museum, and was not able to detect any teeth. I had, however, described a new species, *Parodon paraguayensis*, largely because it differed from *affinis* in having no teeth on the sides of the lower jaw. The two species seem therefore to be synonymous. None of the many specimens examined have teeth in the mandibles. The figure (Pl. XI, fig. 1) is from the type of *P. paraguayensis*.

4. **Apareiodon hasemani**, sp. nov. (Plate XII.)

6587 *a*, C. M. **Type**, 75 mm. Pirapora, Dec. 15, 1907. Haseman,  
6585 *a-l*, C. M. **Paratypes**, 61-75 mm.; same place and date. Haseman.

6584 *a-f*, C. M. **Paratypes**, 35-63 mm. Cidade do Barra, Dec. 6, 1907. Haseman.

6583 *a-f*, C. M. **Paratypes**, 44-68 mm. Januaria, Dec. 12, 1907. Haseman.

6586 *a*, C. M. **Paratype**, 53 mm. Lagoa Pereira, Dec. 23, 1907. Haseman.

6582 *a-j*, C. M. **Paratypes**, 72-85 mm. Penedo, March 20, 1908. Haseman.

Head 4.5-5; depth 4.5; dorsal 11 or 12. Anal 7 or 8; interorbital equal to snout, 3 in head in the smaller specimens; 2.66 in 6582 *a*, in which the interorbital is a trifle greater than the snout. Lateral line  $\frac{36}{4^2}$ ,  $\frac{37}{9}$ ,  $\frac{38}{9}$ ,  $\frac{40}{3}$ ,  $\frac{41}{1}$ . Predorsal scales  $\frac{10}{2^2}$ ,  $\frac{11}{21}$ ,  $\frac{12}{3}$ ; depth of caudal peduncle half, or more than half the greatest depth.

In general shape like the other species of the genus; dorsal and ventral profiles equally curved from the snout; mouth inferior, below the middle

<sup>2</sup> Number of individuals having the given character.

point between snout and eye; four premaxillary teeth, *only one maxillary tooth*; no mandibular teeth.

Base of the dorsal a little nearer the snout than to the end of the lateral line; second, third, and fourth rays projecting slightly, equal to head less half the opercle; origin of ventrals about equidistant from snout, and middle of dorsal; ventrals reaching anus, or a little shorter.

Straw-colored, probably translucent in life; sides of head metallic silvery; a silvery lateral band with a sharp ventral margin; chromatophores on the upper half of the scales of the lateral line in front, on the entire scale of the lateral line on the caudal peduncle, continued as a dark streak on the middle rays of the caudal; upper part of snout in front of nares dark, upper half of opercle with numerous chromatophores; very faint dark shades across the back. The color is *potentially* like that of *affinis* of the same size. The chromatophores are similarly distributed, but less intensely pigmented.

6582 *a-j*, 59–85 mm. Penedo, March 20, 1908. Haseman.

The specimens from Penedo are larger than any of the others; the dark shades across the back are more evident, the stripe along the lateral line less evident. The scales are more numerous, the lateral line being  $\frac{39}{2}$ ,  $\frac{40}{7}$ ,  $\frac{41}{1}$ . The latter character evidently varies with the locality; in the Pirapora specimens it is  $\frac{37}{1}$ ,  $\frac{38}{6}$ , in the Januaria specimens  $\frac{36}{1}$ ,  $\frac{37}{1}$ ,  $\frac{38}{1}$ , in those from Cidade do Barra  $\frac{36}{3}$ ,  $\frac{37}{6}$ ,  $\frac{38}{2}$ .

##### 5. *Apareiodon dariensis* (Meek & Hildebrand).

*Parodon dariensis* Meek & Hildebrand, Field Museum Publications, No. 166, Zool. Ser., Vol. X, 1913, p. 83.

*Habitat*.—Western slopes of Southern Panama.

##### 6. *Apareiodon ecuadoriensis* (Eigenmann & Henn).

*Parodon ecuadoriensis* EIGENMANN & HENN, Indiana University Studies, No. 19, 1914, p. 12 (Vinces River, and forest pools).

*Habitat*.—Western slopes of Ecuador.

##### 7. *Apareiodon terminalis* (Eigenmann & Henn).

*Parodon terminalis* EIGENMANN & HENN, Indiana University Studies, No. 19, 1914, p. 12 (Vinces River, and forest pools).

*Habitat*.—Western slopes of Ecuador.

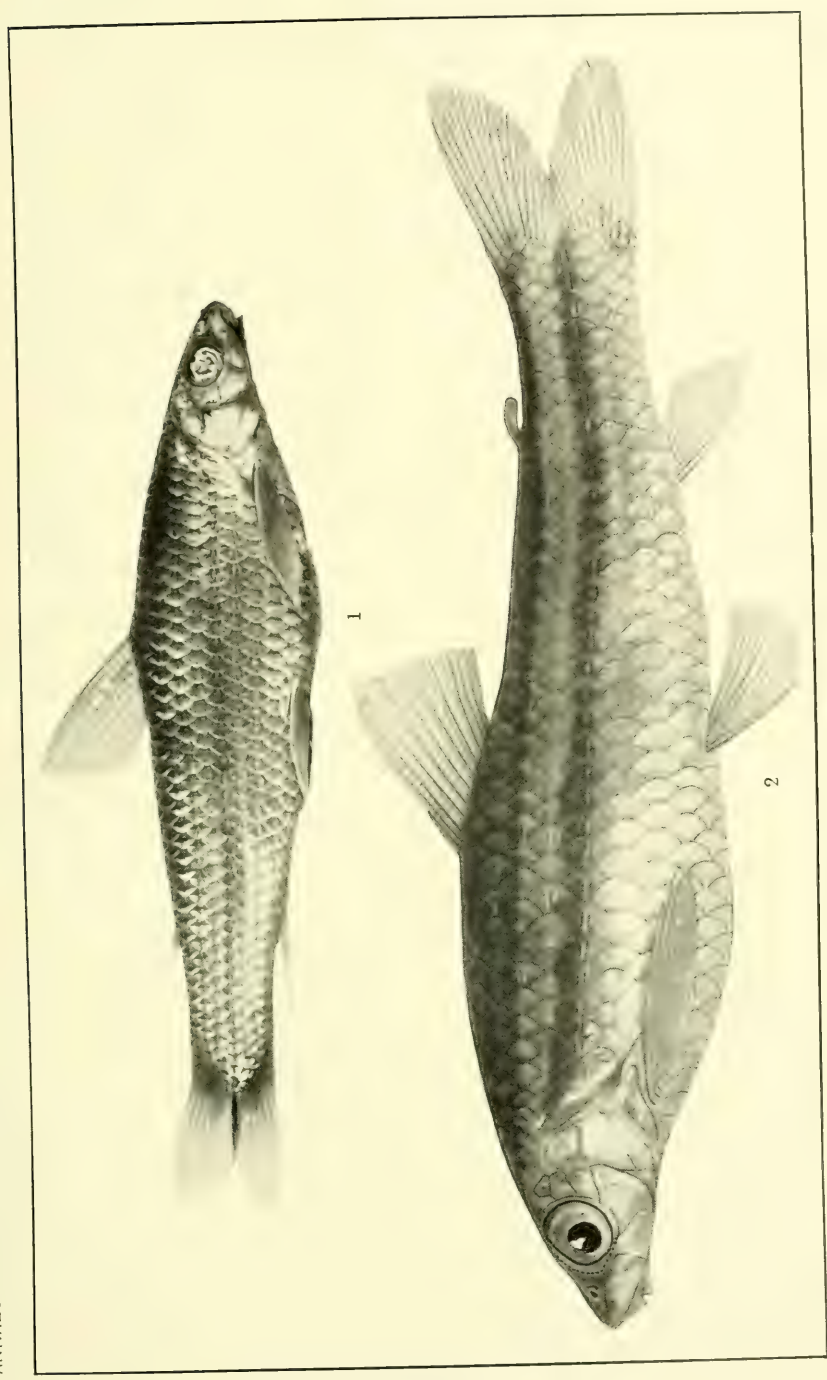
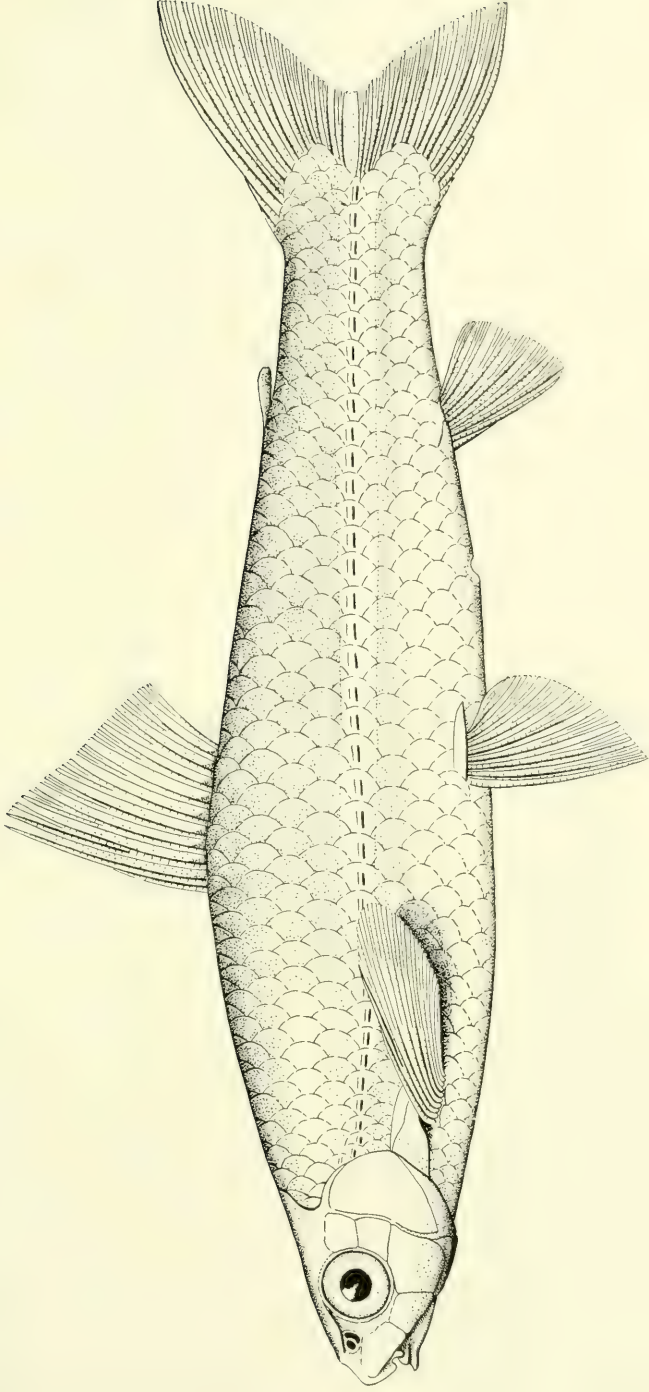


FIG. 1. *Apareiodon affinis* (Steindachner). Type of *Parodon paraguayensis* Eigenmann. No. 9953, I. U. M. 70 mm.  
 FIG. 2. *Apareiodon itapicuruensis* Eigenmann. Type. No. 5804, C. M. Cat. Fishes, 78 mm. Rio Patia.







*Apareiodon hasemani* Eigenmann. Type. No. 6587, C. M., 73 mm. Pirapora.



## VI. NEW AND RARE FISHES FROM SOUTH AMERICAN RIVERS.\*

BY CARL H. EIGENMANN.

(PLATES XIII-XVI.)

Several species of fishes have recently been described by myself, without figures (*Indiana University Studies*, Nos. 20 and 23) and by Fowler<sup>1</sup> (*Proceedings of the Academy of Natural Sciences of Philadelphia*). Fowler's species were for the most part based on small specimens. The notes and figures here given are intended to supplement these descriptions. This paper also includes the description of a new species of Characin, *Stethaprion crenatus*, and of seven new species of Nematognaths. The latter will be figured and more fully described in a forthcoming report upon the fishes collected in Colombia.

### 1. *Agoniates anchovia* Eigenmann. (Plate XIII.)

The description in the *Indiana University Studies*, No. 20, 1914, p. 46, is herewith given and supplemented by a figure of the type, No. 5216 C. M., from Villa Bella on the Amazon (Plate XIII) and by the accompanying figure which shows the dentition of both the upper and lower jaws, greatly enlarged. The original description is as follows:

5216, C. M., **Type** 127 mm., 5217 C. M. **Paratypes**, nine, 87-108 mm. Villa Bella. Haseman.

Head 5; depth 4.75-5; D. 11; A. 31-34; scales 5-45 to 48-4; eye 1.25 in snout, 4.2 in head, 0.8 in interorbital.

Long and slender; head compressed, anchovy-like; preventral area keeled, prepectoral ridge being very sharp; predorsal area rounded, without a complete median series of scales; dorsal profile nearly straight from tip of snout to dorsal; ventral profile regularly arched from the chin to the ventrals; occipital process about 13 in the distance from

\* Contribution from the Zoological Laboratory of Indiana University, No. 144.

<sup>1</sup> *Gymnocorymbus nemopterus* Fowler, Proc. Acad. Nat. Sci. Phila., 1914, p. 247. is a synonym of *Ephippocharax orbicularis* (Valenciennes). *Astyanax rupununi* Fowler is a synonym of *A. bimaculatus*.

its base to the dorsal; skull slightly rounded, narrowed forward; frontal fontanel extending to above the anterior margin of the pupil, narrower



FIG. 1. Mouth of *A. anchovia* Eig. (greatly enlarged).

than the parietal, but of about equal length; mouth very oblique, narrow, a distinct angle between the premaxillary and the maxillary, the upper anterior margin of which is rounded; lower jaw with about ten conical teeth, the first small, the next two larger and equal, the third very long, the middle one of the remainder largest; a pair of small conical teeth behind the first pair of the front series; premaxillary with three conical teeth in an outer series and four long conical teeth graduated from the large first one, a minute notch on one or both sides of these teeth near their tip; maxillary with about twenty conical teeth, smallest and close-set near the premaxillary; second suborbital leaving a wide naked margin; gill-rakers 7+13, the lower limb of the arch long; adipose lid leaving only the pupil free.

Lateral line complete, sharply decurved on its first four scales and then running straight to the middle of the lower caudal lobe; fins naked; axillary scales large; a large flap just above the pectoral more than half the length of the head.

Dorsal very small, its origin equidistant from base of middle caudal rays and head or nearer the former; adipose fin small; anal low, its origin under the origin of the dorsal; ventrals very small, almost half as long as the head; pectorals large, longer than head.

A dusky stripe from upper angle of opercle to the middle of the caudal.

## 2. *Corydoras metæ* Eigenmann. (Plate XIV, Fig. 1.)

Only the type of this species is known. The description in the *Indiana University Studies*, No. 23, 1914, p. 230, is supplemented by the figure cited above.

## 3. *Otocinclus spectabilis* Eigenmann. (Plate XIV, Figs. 2 and 3.)

Ten specimens of this species were collected by Gonzales at Villavicencio. The description in *Indiana University Studies*, No. 23,



1914, p. 229, is supplemented by the figures of the type, No. 13451, I. U. M.

#### GNATHOCHARAX Fowler.

*Gnathocharax* FOWLER, Proc. Acad. Nat. Sci. Phila., 1913, p. 560, fig. 19.

Type, *Gnathocharax steindachneri* Fowler.

Closely allied to *Gilbertolus* of transandean Colombia, with which it agrees in the broad but trenchant breast, the large pectorals which reach the anal, in the length of the anal, the position of the dorsal over the anal, the shape and size of the mouth, etc. It resembles in the general form the species of the genus *Charax*. It differs from *Gilbertolus* in having four canines of about equal size in the portion of each mandible opposed to the premaxillary; two small conical teeth between the first and second canines, and about fourteen sharp, pointed teeth along the portion of the mandible opposed to the maxillary; premaxillary with a series of about fourteen conical teeth, those opposed to the canines of the lower jaw smaller than the others; maxillary with a series of over twenty conical teeth along its entire length; maxillary slipping under the pre-orbital for most of its length, its posterior edge thickened; lateral line short.

This is the *Gnathocharax* of Fowler. Fowler says his specimens have no maxillary teeth, three pairs of canines in the lower jaw, and no axillary scale. He places it with the Chalcininae, to which it is but very remotely related. His specimens are very small and the size and difficulty of making out the characters account for the apparent differences.

#### 4. *Gnathocharax steindachneri* Fowler. (Plate XV.)

*Gnathocharax steindachneri* FOWLER, Proc. Acad. Nat. Sci. Phila., 1913, p. 561, fig. 19 (Igarapé de Candelaria, tributary of the Madeira; Madeira river; tributary of Madeira near Porto Velho).

6608 a, C. M. 56 mm., Manáos, Nov. 30, 1909. Haseman.

Head 4+; depth 3.33; D. 9; A. 31; scales 36, eleven between dorsal and anal; eye 2.4 in the length of the head; interorbital equals snout, 4+ in the length of the head.

Compressed; ventral profile from chin to ventrals a segment of a circle, anal base straight; profile from snout to occiput slightly concave, from occiput to dorsal slightly curved, from origin of dorsal to caudal similar to the corresponding ventral profile; breast broader than any other portion of the body, with a median ridge; back narrow, about

eighteen predorsal scales, not forming a distinct median series; occipital process short, extending about one-eighth the distance to the dorsal; fontanels large, the anterior very sharp-pointed in front, as long as the parietal.

Mouth very large and very oblique, the preorbital very narrow; maxillary-premaxillary border equal to the length of the head without the opercle; maxillary very slender, reaching to below the middle of the eye, nearly to the angle of the mandible; suborbitals covering the entire cheek, preopercle very narrow, gill-membranes free from each other and from the isthmus. Gill-rakers about  $2 + 7$ ; origin of dorsal equidistant from eye and end of the lateral line; dorsal pointed, about equal to the head; adipose well-developed; caudal forked, the lobes a little shorter than the head; origin of anal about equidistant from tip of snout and end of lateral line; height of anal lobe about equal to head without opercle; ventrals small, reaching anal; pectorals very large, reaching the anal, with seventeen rays.

Caudal naked, a few scales in a single row along the bases of the anterior anal rays; a small axillary scale. Scales thin, without radial striæ, everywhere regularly imbricate; lateral line indicated on about five scales.

5. *Stethaprion crenatus* sp. nov. (Plate XVI.)

5228 *a-c*, C. M. **Type** (*a*) 95 mm., **paratypes** 53 and 85 mm. San Joaquin, Bolivia, September 4, 1909. Haseman.

5756 *a*, C. M. **Paratype** 96 mm., Cachoele de Riberão de Rio Madeira, October 17, 1909. Haseman.

Head 4; depth 1.5 in largest, 1.75 in smallest; D. 12; A.  $3 + 42$  or 43; scales 21 to 23-66 or 67-16 or 17; eye 3 in head, interorbital 2-2.33.

Much compressed; dorsal profile steep to the dorsal, depressed over the eyes; ventral profile a nearly perfect segment of a circle from the gill-opening to the end of the anal; predorsal line scaled, but without a regular median series of scales; about five series of narrow scales ending in spines along the ventral edge, the scales on either side of these not quite symmetric; occipital process extending one-third of the distance to the dorsal; frontal fontanel oval, considerably shorter than the parietal, its anterior margin over front of pupil; a naked area about a fourth as wide as the second suborbital at its widest point, extending around its entire free margin; maxillary-premaxillary border longer than eye; premaxillary with four teeth in the outer series, five

five-pointed teeth in the inner series; mandible with four five-pointed teeth and about eight abruptly smaller, mostly conical teeth on the sides; maxillary with one or two teeth. Gill-rakers about  $11 + 16$ .

Origin of dorsal little nearer tip of snout than base of caudal, its highest ray 3.4-4 in the length; adipose scaled on its basal half, preceded by a short dermal ridge; caudal lobes about as long as the head; origin of anal equidistant with origin of dorsal from the end of the

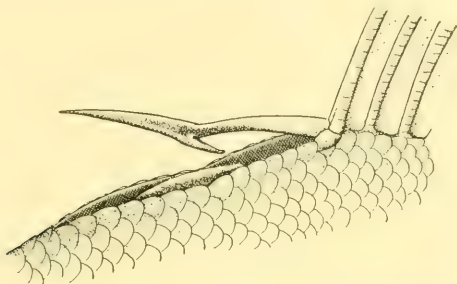


FIG. 2. Predorsal spine of *Stethaprion crenatus* Eigenmann. (Greatly enlarged.)

lateral line; margin of anal slightly rounded, without a lobe; ventrals about equal to the postorbital part of the head, their origin equidistant between tip of snout and origin of the dorsal; pectorals almost as long as head, reaching beyond the line joining origins of dorsal and ventral.

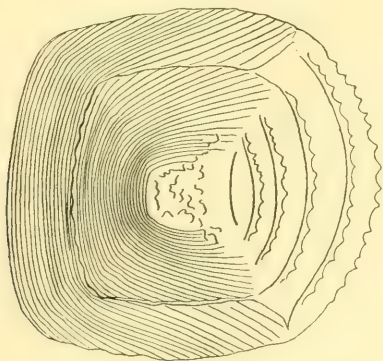


FIG. 3. Scale of *Stethaprion crenatus* Eigenmann. (Greatly enlarged.)

Scales covering all but a narrow fringe of the caudal and anal; concentric free edges of the scales crenate; the scales symmetrically arranged except over anal musculature. No distinct markings.

6. *Trachycorystes fisheri*<sup>2</sup>, sp. nov.

6667 *a*, C. M., **type**, 217 mm., male, Rio Sucio, Eigenmann.

6668 *a-e*, C. M.; 13495 I. U. M., **paratypes**, 151-226 mm. Rio Sucio. Eigenmann.

6669 *a*, C. M.; 13496 I. U. M., **paratypes**, 75-103 mm. Quibdo. Wilson.

6670 *a-f*, C. M., 13497 I. U. M., **paratypes**, 46-89 mm. Rio Truando. Wilson.

D. I, 6; A. 21-25 (Type 24); head 4-4.5; width of head 4-4.5; depth 3.3-4; snout 2.7-3 in head; eye 1.5-2 in snout.

Head flat, granular, as broad as long. Profile of head slightly convex to above the eye, thence strongly concave to the articulation of the dorsal spine. Maxillary bone extending beyond gill-opening in adult male; to anterior border of eye in adult female. Adipose short, 3 in head. Dorsal spine equal to length of head, which is equal to length of pectoral spine, curved forward in male, with entire anterior surface covered with short, heavy, irregularly placed spines; in the female straight and almost smooth. Humeral process short and pointing slightly upward, reaching only one-third of the distance to the end of the pectoral spine. Pectoral spine strong with strongly recurved teeth on its inner margin; its outer margin almost smooth. Creamy white below, brownish above. Back and sides covered with very black, irregular, longitudinal flecks and streaks, much more abundant dorsally. Middle of caudal with a dark bar in most specimens.

7. *Imparfinis microps* Eigenmann and Fisher, sp. nov.

8778, C. M., **type**, 75 mm. Rio Negro at Villavicencio, Colombia. Gonzales.

Head 5.5; depth 7; D. 7; A. 12; snout 2.6 in the head; interorbital nearly 4; eye 12 in the head, nearly 5 in the snout; adipose fin 4.4 in the length.

Head depressed; jaws equal; all barbels extending to gill-openings, when laid straight back; origin of dorsal behind vertical from front of ventrals; base of anal slightly less than length of head.

Fins hyaline, body with numerous brown chromatophores, more abundant on back and anteriorly.

<sup>2</sup> Named for Carl G. Fisher, of Indianapolis, who helped to make possible a second expedition to the type locality of this species.

8. *Nannorhamdia nemacheir* Eigenmann & Fisher, sp. nov.

7125, C. M., **type**, 105 mm., Girardot, Colombia. Eigenmann.

Head 5; depth 7; D. 7; A. 10 or 11; eye 5 in the head; snout 2.4-3; interorbital .8.

First dorsal and pectoral rays prolonged beyond the rest of the fin, the prolongation more pronounced in the female than in the male; maxillary barbel reaching to the end of the ventral.

A narrow, dark, lateral band, indistinct in some specimens. A dark band across the nape, other cross-shades at the origin, at the latter half, and behind the tips, of the short rays of the dorsal. Fins hyaline;

## CETOPSORHAMDIS Eigenmann &amp; Fisher, gen. nov.

First dorsal and first pectoral rays not spinous; anal moderate; lower caudal lobe the longer; origin of ventrals under the dorsal; adipose fin three times as long as high; a small frontal fontanel, far removed from the long parietal fontanel; skull covered with skin, not granular; occipital process minute; orbit without a free margin; head subconical, the snout projecting. Vomer and palate without teeth.

9. *Cetopsorhamdia nasus* Eigenmann & Fisher, sp. nov.

7124, C. M., **type**, 72 mm. Honda, Colombia. Eigenmann.

Head 4.3; depth 6.25; adipose 6.3; snout 2.5 in head; eye 7.5 in head, 2 in interorbital; D. 7; A. 10.

Maxillary barbel reaching a little beyond the beginning of the pectorals; base of anal shorter than adipose.

Everywhere with small purplish dots, which are most numerous dorsally. A dark band at base of caudal. A light band, about as wide as the eye, across the base of the occipital.

10. *Ancistrus melas* sp. nov.

7335, C. M., **type**, male, 106 mm.; 13650, I. U. M., **paratypes**, two, 62 mm., Condoto. Wilson.

7336a, C. M.; 13651, I. U. M., **paratypes**, two, 52 and 65 mm. Raspadura. Wilson.

These specimens came from contiguous localities on opposite sides of the continental divide.

D.I, 7; A.I, 4.

Length to end of plates at base of caudal 78 mm.; length of head



28 mm.; its width 23 mm.; depth of body 13 mm.; eye 4 mm.; interorbital 12.5 mm.; ramus of lower jaw 3.1 mm.; first dorsal ray 25 mm.; last dorsal ray 13 mm.; distance between dorsal and spine of the adipose fin 12 mm.; depth of caudal peduncle 9 mm.; length of caudal peduncle from anal to base of the plates at root of caudal 20 mm.; outer ventral ray 21 mm.; pectoral spine 29 mm.

Snout with a narrow naked margin, with eight small tentacles, only the two median ones bifid; no tentacles on middle line of head; about fourteen interopercular spines. Twenty-four scutes in the median series, six between dorsal and adipose, eleven between anal and caudal; pectoral extending to third fifth of ventrals, ventrals to tip of anal; caudal obliquely truncate, length of upper ray 25 mm., length of lower 30 mm.

Black, tips of the fin-rays very narrowly light.

The larger specimen from Raspadura (13651 I. U. M.) has six tentacles. The two smaller specimens from Condoto and the smaller one from Raspadura have each a small tentacle on the margin of the snout near the angle of the mouth, none elsewhere; but tentacles are indicated also along the anterior part of the margin of the snout in one of the smaller specimens from Condoto.

#### II. *Hemiancistrus landoni* sp. nov.

13654, I. U. M., **type**, 255 mm. over all. Naranjito, Ecuador. Henn.

Head 3.14; depth 5.35; D.I, 7; A.I, 4. Length to plates at root of caudal 198 mm.; length of head 63 mm.; width of head 60 mm.; depth of body 37 mm.; eye 7 mm., interorbital 22 mm., snout 37 mm., ramus of lower jaw 11 mm. Scales along the side 26 + 1 at root of caudal; 7 between dorsal and adipose, 15 between anal and caudal fulcrum, base of dorsal equal to its distance from the middle of the spine of the adipose; length of caudal peduncle 68 mm. from anal to base of plates at root of caudal.

About ten large interopercular spines and numerous graduated smaller ones, the longest of the larger spines about 2.66 in the head. ventral surface entirely covered with small plates; supra-occipital with a slight median elevation, bordered by a single plate; plates of sides carinate, the ridges on the second row from the top strongest; length of dorsal spine but little less than length of head. Pectoral spine with strong hooks toward the tip, reaching second third of ventrals; ventrals beyond base of anal. Caudal symmetric, very

slightly emarginate, the outer rays a little prolonged. Four dark cross-shades, one behind eyes, one at end of dorsal, one at adipose, and one at base of caudal; a row of large dark spots on each of the dorsal membranes; caudal, anal, ventrals, and pectorals with similar spots on rays and membranes; similar obscure dark spots on the sides, larger ones on the belly; faint light streaks along the carinae of the lower rows of plates.

Named for Hugh McK. Landon of Indianapolis.

#### 11. *Pseudancistrus carnegiei* sp. nov.

7346, C. M., **type**, 110 mm.; 13661 I. U. M., two **paratypes**, 87 and 110 mm. Rio San Gil, Santander, Colombia. Gonzales.

7347a-d, C. M., **paratypes**, 13662, I. U. M., nine, largest 41 mm. Quebrada de Honda, Santander, Colombia. Gonzales.

Most readily distinguished by the number of dorsal rays.

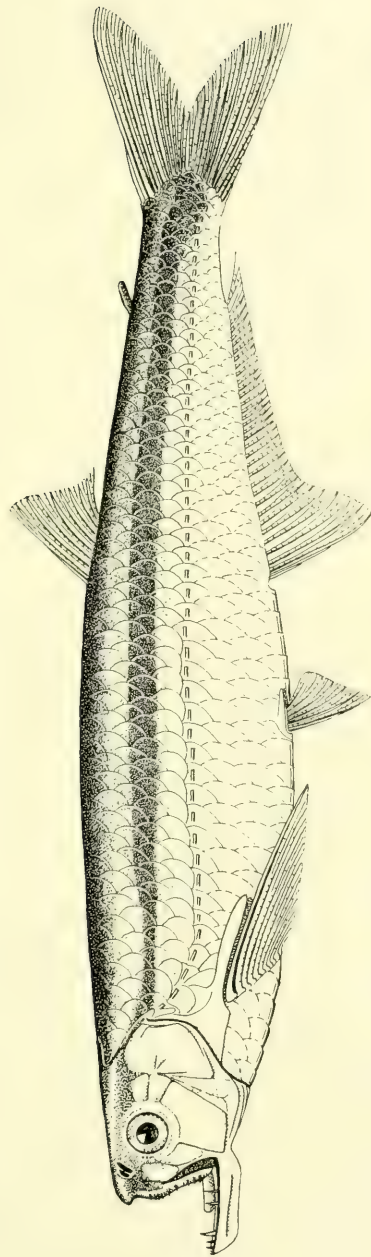
#### MEASUREMENTS OF TWO MALES, THE TYPE AND LARGEST PARATYPE FROM THE RIO SAN GIL.

	Mm.
Length to base of plates at root of caudal.....	82
Length of head.....	30
Depth of body.....	15
Width of head.....	30
Depth of head.....	13
Interorbital width.....	7.5 and 8
Ramus of lower jaw.....	9
Length of snout.....	18
Length of eye.....	3
Length of dorsal spine.....	15 and 17
Length of last dorsal ray.....	11 and 12
Length of base of dorsal.....	20 and 21
Distance of dorsal from spine of the adipose.....	12.5 and 12
Length of caudal peduncle.....	20.5 and 22
Depth of caudal peduncle.....	8 and 8.5
Length of pectoral spine.....	35
Length of ventral.....	20 and 21.5
Length of anal.....	10
Distance from snout to dorsal.....	37 and 38
Distance from snout to ventral.....	41

Head 2.66; depth 5.46; D.I, 9 in nine of the specimens, I, 8 in two; A.I, 5; plates 25 or 26, 7 between the dorsals, 10 or 11 between anal and caudal; eye 10 in the head; ramus of lower jaw a little greater than interorbital.

Head depressed, without ridges; snout broadly rounded, margined with short, thick bristles; interopercle with about eight spines, the longest in the smaller specimen, a female from Santander, being about one-third as long as the head. The longer ones are lost from the larger males; last dorsal ray joined at the base only to the scute following it; caudal slightly, but very obliquely, emarginate; pectoral spine in the male reaching beyond middle of ventrals, shorter in the female. Scutes spinulose, not carinate; lower surfaces of head and body naked. Adult nearly uniformly dark brown, all the fins with obscure spots on the rays; caudal in the young with two or more cross-bars.

Named in honor of Mr. Andrew Carnegie, the founder of the Carnegie Museum.



*Agoniatos anchovia* Eigenmann. Type. No. 5216, C. M., 127 mm. Villa Bella.





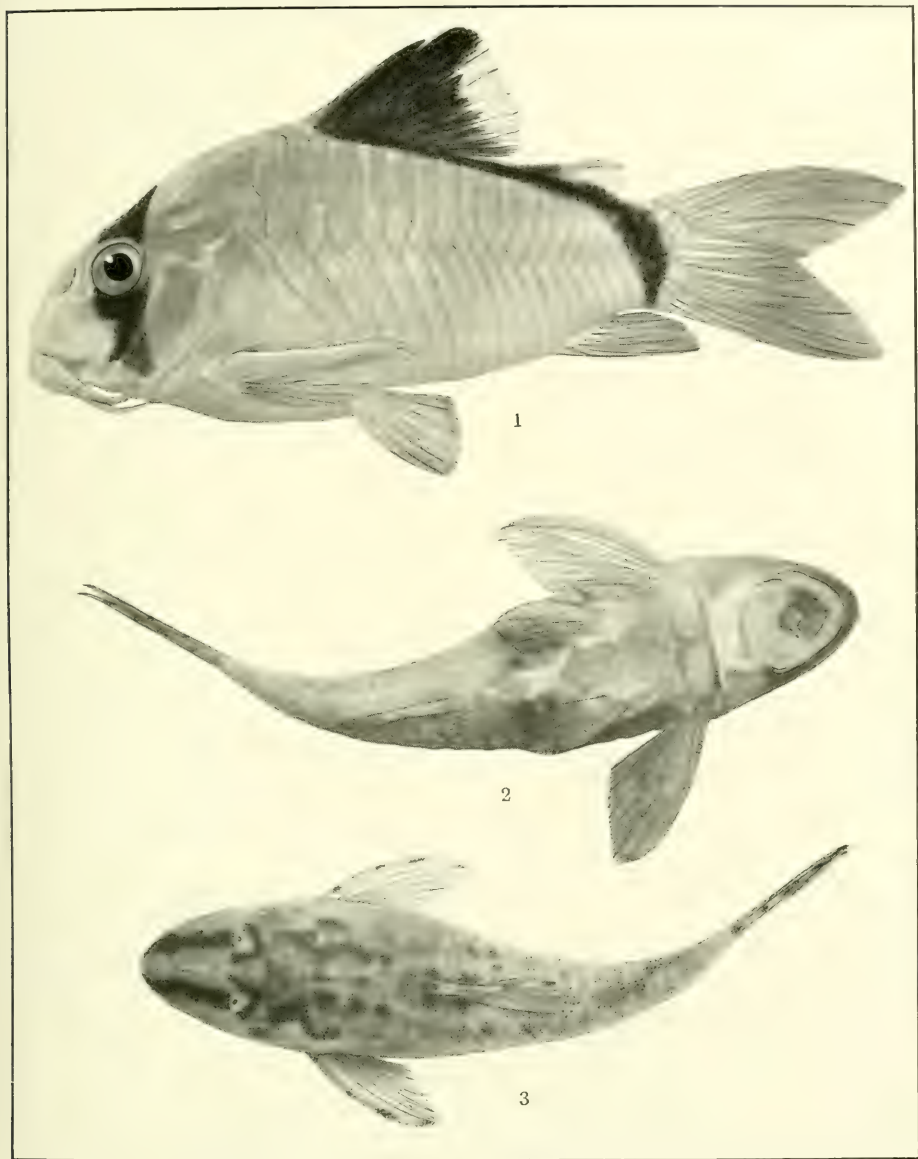
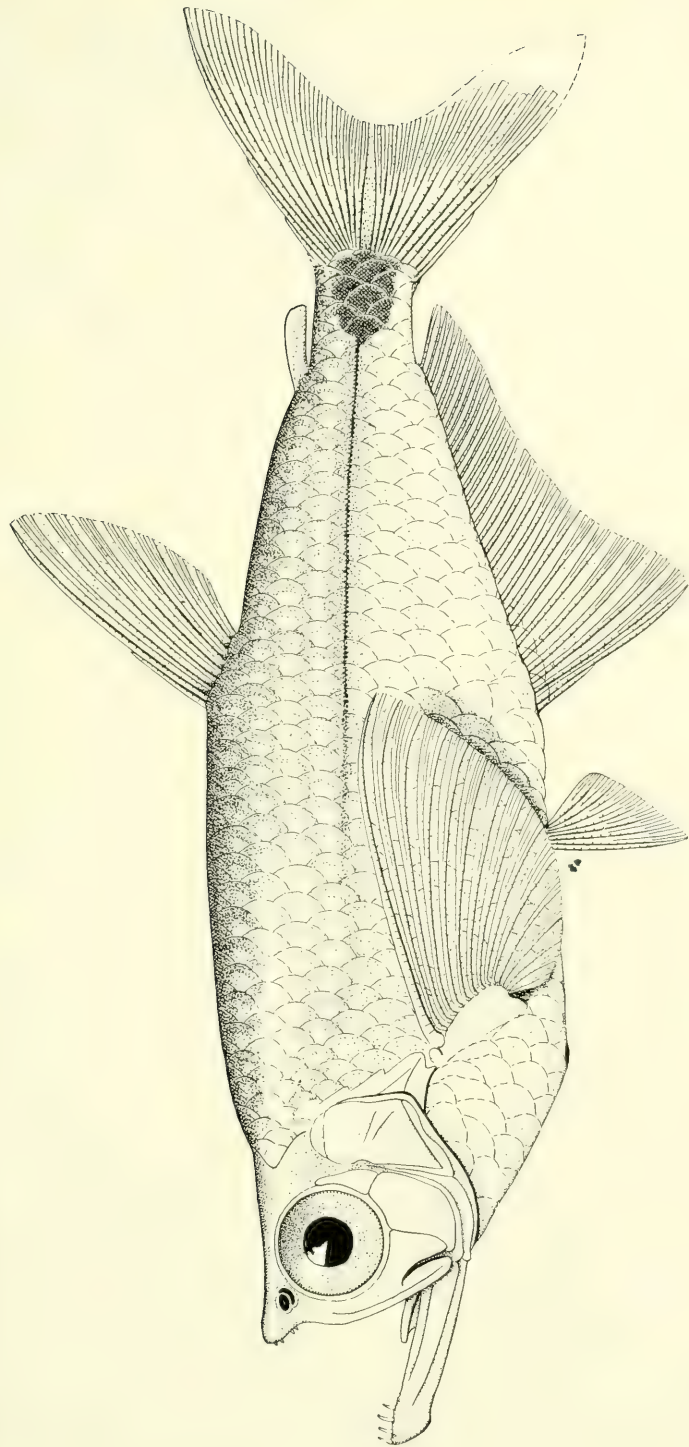


FIG. 1. *Corydoras meta* Eigenmann. Type. No. 13451, I. U. M., 54 mm. Barrigona.

FIG. 2. *Otocinclus spectabilis* Eigenmann. Type. No. 13253a, I. U. M., 38 mm. Villaviciencio. Gonzales Coll. (Inferior view.)

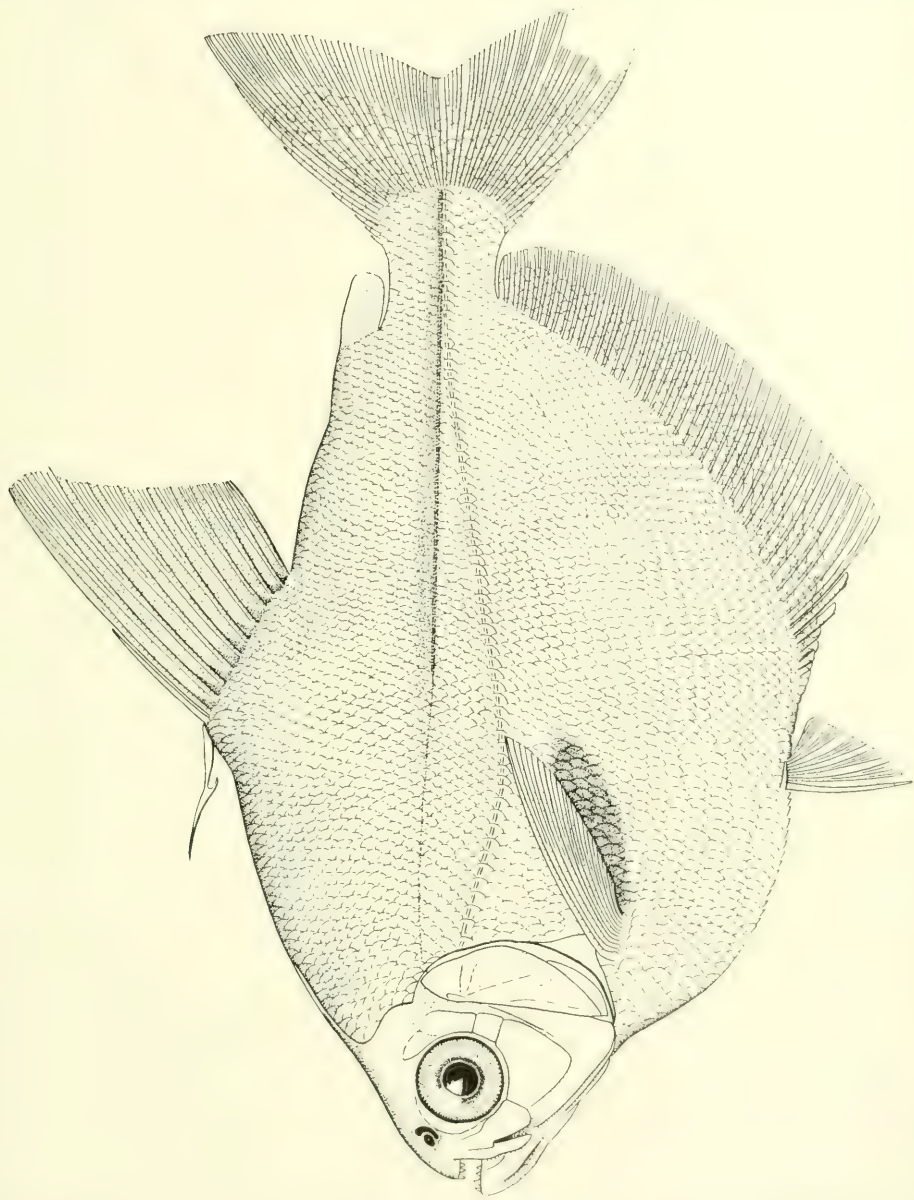
FIG. 3. *Otocinclus spectabilis*. (Superior view.)





*Gnathochorax steindachneri* Fowler. No. 6608, C. M., 56 mm. Manáos.



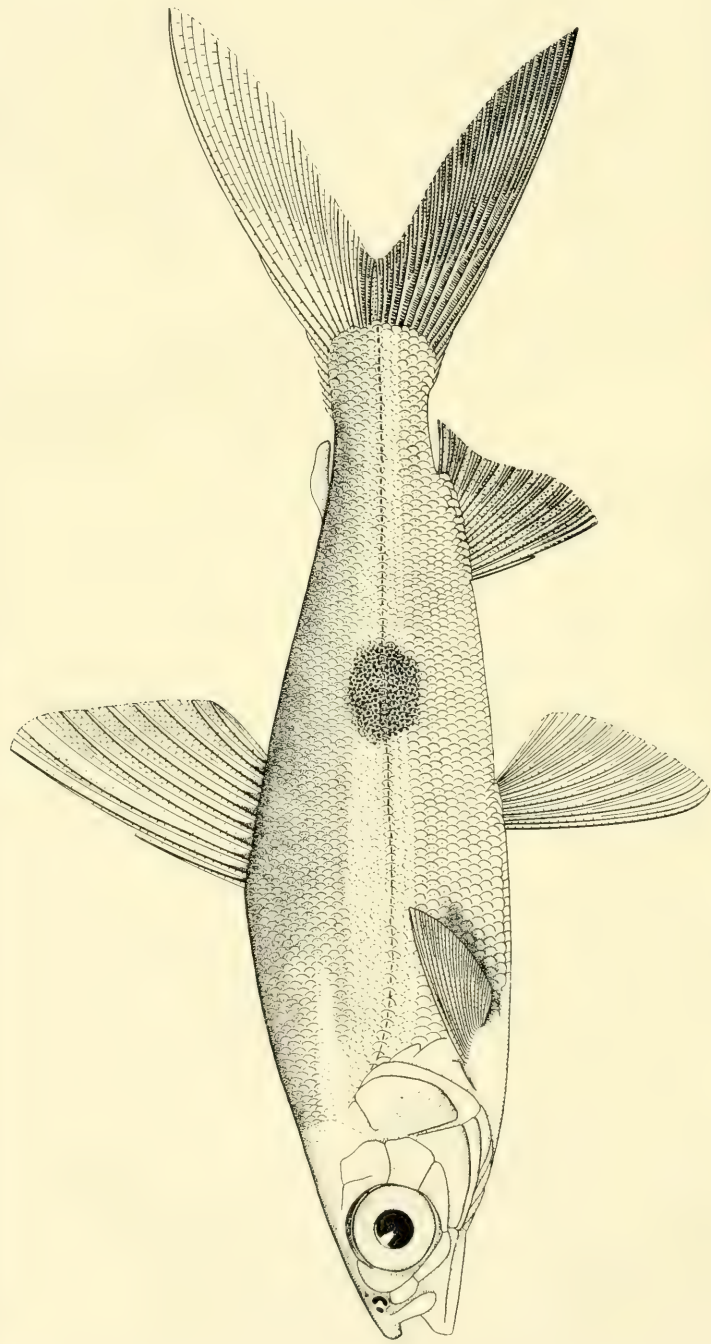


*Stethaprion crenatus* Eigenmann. Type. No. 5228, C. M., 95 mm. San Joaquin, Bolivia.









*Hemiodus parnagae* Eigenmann & Henn. Type. No. 5701, C. M., 57 mm. Lagoa de Parnagua.

## VII. DESCRIPTION OF THREE NEW SPECIES OF CHARACID FISHES.<sup>1</sup>

BY CARL H. EIGENMANN AND ARTHUR W. HENN.

(PLATE XVII.)

### 1. *Hemiodus parnaguæ*, sp. nov. (Plate XVII.)

5701, C. M., **type**, 57 mm.; 5762 *a-b*, C. M., 48-62 mm.; 13541, I. U. M., 64 mm., **paratypes**. Lagoa de Parnagua, Jan. 17, 1908. Haseman.

Related to *Hemiodus longiceps* Kner and *H. microlepis* Kner.

Head 3.5-3.6; depth 3.5-4; D. 10-11; A. 11-12; scales 20-80 to 83-12. Eye equal to, or slightly greater than, snout, 3.5 in head, 1 in interorbital.

Slender, compressed; dorsal and ventral profiles equally arched; snout pointed; mouth sub-terminal. A single series of about twenty multicuspid teeth in the upper jaw.

Origin of dorsal equidistant from tip of snout and tip of adipose, the height of its second ray, which is longest, equal to the head plus one-third of the eye. Anal emarginate, its origin twice as distant from a point between the eye and the edge of the opercle, as from the base of the caudal. Adipose elongate, slightly less in length than the eye. Caudal deeply forked, lobes longer than head; pectorals lanceolate, not reaching ventrals, the latter barely reaching the vent.

Lateral line slightly decurved in front, thence horizontal, very slightly below the mid-line of the body. Scales minute, cycloid, in well defined rows, with few striæ; lower abdominal rows but slightly increasing in size. A large axillary scale; fins naked.

A silvery lateral streak; opercle shining silvery; an oval black spot nearly the size of the eye, midway between the end of the dorsal and the origin of the anal. The upper half of the lower caudal lobe is black and the lower half is speckled with scattered chromatophores. Outer half of anal black; other fins colorless.

A single mutilated specimen from the same locality (5703 C. M.) apparently this species, has the following characters: length to broken

<sup>1</sup> Contributions from the Zoological Laboratory of Indiana University, No. 145.

end of caudal peduncle 113 mm.; head 4.5; depth 3.8; D. 11; scales 20-82-12; teeth 34.

2. *Leporinus ecuadorensis* sp. nov.

13116 *a*, I. U. M. **Type**, 325 mm. Rio Barranca Alta near Naranjito, Ecuador, Arthur Henn.

5428 *a-b*, C. M.; 13116, I. U. M. Six **paratypes**. Largest 187 mm. Rio Baranca Alta, Naranjito. Henn.

5426 *a-i*, C. M.; 13113, I. U. M. Nineteen, 128-264 mm. Vines. Henn.

5427 *a-b*, C. M.; 13114, I. U. M. Several. Guayaquil. Henn.

13115, I. U. M., several. Colimes. Henn.

This species differs from typical specimens of *L. friderici* from British Guiana, chiefly (1) in having the dorsal set farther back, *i. e.*, equidistant from snout and a point midway between the adipose and caudal; (2) the anal set somewhat farther forward and very seldom reaching the caudal; and (3) the presence of three persistent lateral spots. *L. muyscorum* has the dorsal as in *L. friderici*, but the sharp caudal and the anal placed as in this species. *L. muyscorum* and the present form should probably be regarded as subspecies of *L. friderici*.

Head 3.8-4.2  $\left(\frac{3.8}{2}, \frac{3.9}{1}, \frac{4}{20}, \frac{4.1}{1}, \frac{4.2}{1}\right)$  denominator representing the number of individuals having the given character; depth 3.3-3.8  $\left(\frac{3.3}{4}, \frac{3.4}{4}, \frac{3.5}{12}, \frac{3.6}{4}, \frac{3.8}{2}\right)$ ; D. 12-13  $\left(\frac{12}{25}, \frac{13}{1}\right)$ ; A. 10, in twenty six specimens; scales 5-39 to 41-4 or 5  $\left(\frac{39}{1}, \frac{40}{20}, \frac{41}{5}\right)$ ; eye 1.5-2 in the snout, 4.5-5.5 in head, 2-3 in interorbital; four teeth in each side of each jaw.

Origin of dorsal equidistant from the tip of the snout and a point beyond the adipose or generally midway between the adipose and the base of the upper caudal fulcrum. The height of the third or longest dorsal ray is equal to the head less one-half of the opercle. Caudal sharp, deeply forked, not obliquely truncate or lobate, as in *L. friderici*, the upper lobe about half an orbital diameter longer than the lower. Anal but slightly emarginate, the distance from its origin to the base of the caudal equal to the head, or the head plus an orbital diameter. The height of the third or longest ray equals the head minus the snout; only very rarely reaching the lower caudal fulcrum as is commonly



the case in *L. friderici*. Pectorals reaching nearly three-fourths of the distance to the ventrals, the latter more than half way to the anus.

Each scale of the sides and back has a dark area at the base. Dorsal area steel-blue or bluish-green, ventral region and belly yellowish. Young specimens have alternating bluish blotches and transverse pinkish bars on the back. Sides with a series of three heavy black spots or blotches, the first below the dorsal, or midway in the length without caudal, the third at the end of the caudal peduncle, and the center one ending before the vertical from the adipose. These are present in all specimens, and occupy each about four scales in the lateral line and the series beneath it. Dorsal, pectorals, and caudal dusky, without definite bands of color; ventrals and anal blackish, with a broad, white, outer margin.

### 3. *Astyanax magdalenæ* sp. nov.

5822 a, C. M., **type**, 53 mm. Girardot. Eigenmann.

13611, I. U. M., **paratype**, 61 mm. Apulo. Gonzales.

Closely related to *A. stilbe* (Cope) differing in the greater depth, the shorter anal, and the lack of a median series of preventral scales.

Head 3.5-3.8; depth 2.33; D. 11; A. 33-34; scales 8-36 or 37-7 (to ventrals), snout 1.3 in eye, 4-4.5 in head; eye 3-3.3 in head and equal to interorbital.

Dorsal and ventral profiles equally and strongly arched; predorsal area without a median series of scales, those of the two sides overlapping, an occasional median scale near the origin of the dorsal; preventral area keeled, scales of the two sides apposed in the mid-line.

Interorbital convex, smooth; occipital process elongate, sharp, about one-fourth of the distance from its base to the dorsal, bordered by three large scales. Frontal fontanel bluntly triangular, as wide as the parietal and about two-thirds as long as the parietal without the occipital groove. Second and third suborbitals leaving a narrow naked margin behind and below. Maxillary as long as the eye, shorter than the mandible, which is equal to the snout and half the length of the eye.

Premaxillary with four broadly tricuspid teeth in the outer row and five brown-tipped four- to five-pointed teeth in the inner row. Maxillary with a single minute tooth in the upper angle. Mandible with five sharp three- to four-pointed teeth.

Origin of dorsal about equidistant from the snout and the base of the caudal, or slightly nearer the snout, its anterior rays 3.4 in the length; caudal sharp, lobes equal and as long as the head; anal not emarginate, short, its longest ray equalling length of ventrals or the head without snout and half the eye. Origin of anal slightly in advance of vertical from last dorsal ray.

Scales regularly imbricate, below the lateral line from above the ventrals posteriorly they are deflected or decurrent to the anal. Anal sheath, a single row of oblong scales decreasing in size progressively towards the last rays; a short axillary scale. Lateral line gently decurved throughout its length.

Silvery; a lateral streak of bright silver from operculum to caudal; a single round black humeral spot; a horizontally oval spot at the end of the caudal peduncle.

## VIII. ON THE SPECIES OF SALMINUS.

By CARL H. EIGENMANN.

The species of the genus *Salminus* are salmon-like characid fishes found in the Trans-andean region of Colombia and northern Ecuador, in the La Plata basin, and northward into the San Francisco basin, and sparingly in the Amazon and Orinoco basins. The species are very similar to each other.

### KEY TO THE SPECIES OF SALMINUS.

- a*. Scales between the dorsal and lateral line 14-16; lat. l. 92-98; A. 25-29.  
1. *maxillosus* Cuv. & Val.  
*aa*. Scales between the dorsal and lateral line 11; lat. l. 77-79; A. 27-30.  
2. *brevidens* Cuvier.  
*aaa*. Scales between the dorsal and lateral line 10; lat. l. 66-72; A. 24-26.  
3. *hilarii* Cuv. & Val.  
*aaaa*. Scales between the dorsal and lateral line 12; lat. l. 73.  
4. *affinis* Steindachner.

### 1. *Salminus maxillosus* Cuvier and Valenciennes.

6565 *a-c*, C. M. 119-146 mm. Uruguayana, Feb. 7, 1909. Haseman.

6566 *a*, C. M. 185 mm. Salto Avandava, Sept. 15, 1908. Haseman.

6610 *a*, C. M. 485 mm. Porto Alegre, Jan. 22, 1909. Haseman.

The localities from which this species has been recorded are: Amazon; La Plata; Misiones; Paraguay; Dock Central; Isla Santiago; Puerto Viejo; Asunción.

### 2. *Salminus brevidens* Cuvier.

6559 *a*, C. M. 257 mm. Joazeiro, Nov. 28, 1907. Haseman.

6560 *a*, C. M., about 225 mm. Cidade do Barra, Dec. 6, 1907. Haseman.

6561 *a-c*, C. M. 147-197 mm. Penedo, March 20, 1908. Haseman.

The localities from which this species has been recorded are the Rio San Francisco and the Rio Cipo.

3. *Salminus hilarii* Cuvier and Valenciennes.

- 6562 *a*, C. M. 153 mm. Bom Jardin. Rio Grande above the falls, July 7, 1908. Haseman.  
6563 *a*, C. M. 332 mm. Piracicaba, July 23, 1908. Haseman.  
6564 *a-b*, C. M. 143-145 mm. Sapina, July 29, 1908. Haseman.  
6567 *a*, C. M. 169 mm. Salto Avanhandava, Sept. 15, 1908. Haseman.

The localities from which this species has been recorded are the Rio San Francisco; Amazon; Vermejo; Rio das Velhas; Rio Tieté; Ypiranga; Apuré.

4. *Salminus affinis* Steindachner.

- 12816, I. U. M.; 5023 *a-b*, C. M. 455, 530, and 600 mm. Honda. Eigenmann.

This species has been recorded from the Cauca and from the Rio Santiago in western Ecuador.

## IX. ON VARIOUS SOUTH AMERICAN PÆCILIID FISHES.

BY ARTHUR W. HENN.<sup>1</sup>

(PLATES XVIII-XXI.)

### INTRODUCTORY.

The present account is largely based upon collections made from 1907 until 1910, by Mr. John D. Haseman in central South America, during the expedition of the Carnegie Museum. An account of this expedition with a list of the localities, where Mr. Haseman made collections, was published in these ANNALS, Volume VII, pp. 288-314. A review of the specimens obtained by Professor C. H. Eigenmann during a reconnaissance of the basins of the Magdalena, Cauca, Dagua, San Juan, and Atrato Rivers of Colombia is included. This expedition was under the auspices of the Indiana University and the Carnegie Museum.

Besides this material I have examined and included a list of the specimens obtained in 1913, by Mr. Charles E. Wilson when on the Landon-Fisher Expedition of Indiana University to western Colombia, and those secured by the writer in southwestern Colombia and Ecuador in 1913 and 1914 during the Landon Expedition of Indiana University. A review of the last three expeditions appeared in *Science* for 1914, pp. 602-606.

The numbers, unless otherwise stated, are the catalog numbers of the Carnegie Museum and the Indiana University. A full series of the fishes obtained by the Indiana University Expeditions is included in the collections of the Carnegie Museum. I have had constantly at hand for reference the collections in the Museum of Indiana University, where this paper was prepared.

For the species mentioned I have given in most cases the synonymy and bibliography subsequent to the publication of Garman's monograph of this family: "The Cyprinodonts," Mem. Mus. Comp. Zool., Vol. XIX, No. 1, 1895. In a few cases, where the synonymy in that work was inaccurate or obscure, I have given the complete synonymy since the earliest reference to the species.

<sup>1</sup> Contributions from the Zoölogical Laboratory of Indiana University, No. 125.



The genera defined or accepted in this paper are largely based upon the variously arranged hooks and barbs at the tip of the modified anal fin of the male and the arrangement and shape of the teeth. Dr. Eigenmann (1907, p. 425) first used the former characters in defining genera of Pœciliids. He examined microscopically the anals of a number of species, and among others based the genera *Phalloceros* and *Phalloptychus* on these characters. The study of the anal has been greatly extended in a recent paper by Mr. C. T. Regan (c. 1913),<sup>2</sup> who revised all of the Pœciliinæ. The examination of the anal is somewhat tedious. The anal of the male must be mounted in damar, or balsam, and studied with a compound microscope. Unquestionably, however, such procedure demonstrates true relationships, and no new species should be described without an examination of the anal. These characters are small since the males of these fishes are among the least of vertebrates. Were these fishes larger in size and easily examined, these characters would long ago have been used in generic descriptions. It will be unfortunate, however, if this system should lead to needless multiplication of genera. Some of the closely related genera already recognized by Regan should probably be united.

Within recent years these little fishes on account of their bright colors and interesting habits have been extensively introduced as aquarium fishes, especially into Germany. Various popular accounts have appeared in some of the fanciers' journals, such as the "Wochenschrift Aquarien-Terrarienkunde" and the "Blätter Aquarien-Terrarienkunde." These have not been accessible to me. In a contribution from the Zoölogical Institute of the University of Berlin, Erich Philippi, (d. 1908) has reviewed the more significant of these notices and has added extensive observations of his own. Of this very thorough paper I have given considerable summaries in English, particularly of the parts dealing with the breeding habits. Philippi reared and observed in the aquarium two species, *Phalloceros caudomaculatus* and *Cnesterodon decem-maculatus*. In his account the former is constantly spoken of as *Glaridichthys* (*Phalloptychus*) *januarius*. But he did not have and did not know *P. januarius*, and his systematic deductions are therefore quite in error.

In a number of instances observations, especially in regard to the development and differentiation with age, number of young, etc., are

<sup>2</sup> The reference is to the bibliography of the subject which is given on p. 107.

my own. For such studies I have had at command more than two thousand of *Lebistes reticulatus* and more than eight hundred specimens of *Pseudopæcilia fria*, representing all sizes and conditions, as well as large numbers of other species.

This paper was prepared at Indiana University under the supervision of Professor C. H. Eigenmann, to whom I am under obligations for having given me the opportunity to make these studies, and who aided me by giving me access to the literature, and making valuable critical suggestions. To Dr. W. J. Holland I am indebted for the editorial revision of the manuscript and the reading of the proofs while going through the press.

#### NEW GENERA AND SPECIES.

The following new species and genera are described by the author:

- Rivulus compressus* sp. nov.,
- Diphyacantha chocoënsis* gen. et sp. nov.,
- Heterandria hasemani* sp. nov.,
- Neoheterandria elegans* gen. et sp. nov.,
- Phalloptychus eigenmanni* sp. nov.,
- Phallotorynus fasciolatus* gen. et sp. nov.,
- Limia hollandi* sp. nov.

The following species, considered to be new, are jointly described by Eigenmann and Henn:

- Rivulus magdalenæ* sp. nov.,
- Gambusia caliensis* sp. nov.

#### THE PÆCILIIDÆ.

The Pæciliidæ, or Cyprinodontidæ,<sup>3</sup> were long placed in the heterogeneous assemblage of the order Haplomi. Regan (*a*, 1911) has lately investigated their structure and placed them along with the blind fishes (Amblyopsidæ) in a new order, the Microcyprini. This he divides into the suborders Amblyopsoidea and Pæcilioidea. The principal differences between the Haplomi and the Microcyprini are given in the following extract: "The Haplomi are physostomous, the maxillary enters the gape, the mesethmoid is represented by a pair of dermal bones, and the ribs are borne on autogenous parapophyses. The Microcyprini appear to be physoclistic, the mouth is bordered

<sup>3</sup> Gill (1894, p. 115) gives the reasons for preferring the name Pæciliidæ.

above by the premaxillaries only, the mesethmoid is unpaired, and all or most of the ribs are inserted on strong transverse processes. Whereas the Haplomi show relationship to the more generalized isospondylous fishes, the Microcyprini bear more resemblance to the Salmo-percæ and Synentognathi, especially the latter."

In the Oligocene and Miocene of Europe occur the fossil remains of *Prolebias*, a generalized form, related to the recent genus *Fundulus*. From this central type adaptive radiation has taken place, resulting in considerable modification of the form of the body and structure. Differences in the character of the teeth and the length of the alimentary tract have arisen in the same subfamily through adaptation to a carnivorous or a vegetable diet. In some cases evolution in one species has paralleled that in another, unrelated species. For instance, the ventrals have been lost in *Orestias* and *Empetrichthys*.

The family consists of oviparous forms, in which the eggs are deposited in the usual manner, and viviparous forms, in which the ova undergo development within the ovarian sack and the young are born in a more or less advanced stage of development. The oviparous species are contained in three sub-families, the Cyprinodontinæ, Orestiinæ, and Fundulinæ, in which the sexes do not greatly differ from each other.

Of viviparous forms there are five subfamilies. In these fertilization of the female is effected, with but one exception, with the aid of the anal fin, which is modified to serve as a so-called intromittent organ. In the *Fitzroyiina* or *Jenynsiina*, and the *Anablepina*, both of which are monogeneric and contain but few species, the anal rays are rolled up into a tube. The *Characodontina* resemble the oviparous *Fundulina* in appearance, but the male has the first five or six rays of the anal short and stiff and separated by a notch from the rest of the fin. This subfamily, with the exception of a few species, is found only in the basin of the Rio Lerma of Mexico. This type of anal structure is much more simple than that in the *Pœciliina*, in which the anterior rays are thickened and lengthened to form a lever.

The viviparous forms were thought to be entirely confined to the western hemisphere. Quite recently Regan (*b.* 1913) has described *Phallostethus dunckeri*, a remarkable new Pœciliid and the type of a new subfamily. This fish, which is from Johore on the Malay Peninsula, is viviparous. While in all the other viviparous forms, which

are limited to the Americas, it is the anal fin which serves as the intromittent organ, it seems that in males of this species the ventral fins have become modified into a large muscular appendage, or intromittent organ. This might indicate that viviparity in this subfamily may be of independent origin.

#### POSTNATAL DEVELOPMENT IN THE SUBFAMILY PÆCILIINÆ.

In most of the viviparous forms the sexes at birth are indistinguishable. The anal fin of the male occupies the same position as that of the female, its shape is the same, and the individual rays are clearly apparent. The location is usually below the posterior part of the dorsal fin. As development proceeds, the third, fourth, and fifth rays become lengthened, although they still remain separate and distinct for some time. Eventually these attain their full length and appear to be fused. While distinct, they are closely apposed and form a stiffened rod or lever. The length varies with the different genera; usually it is about one-third of the whole length of the fish. The tip of this intromittent organ is provided with hooks and spines, the arrangement of which differs in the various genera.

While these modifications have been taking place, the whole fin has been gradually moving forward, so that, when development is complete, the position of the fin has changed from abdominal to thoracic. The external openings of the genital tract, the ureter and the intestine, which lie just before the anal, have also moved with it. This migration of the vent is evidently similar to that which takes place in the blind-fish (*Amblyopsis spelæus*), where the opening of the oviduct along with that of the intestine and the ureter move forward, so that the eggs may pass into the gill-chamber, where they are incubated. The ventral fins also travel forward, and the final position of these and of the anal is close up under the pectorals.

A support, which is necessary for the mass of muscles involved in the complicated movements of the anal fin during copulation, is provided in the males through a modification of the posterior præcaudal vertebræ. A process or stay extends forward from each of the arches uniting the parapophyses of the last few præcaudal or rib-bearing vertebræ. In the vertebræ thus modified the ribs are absent, but their places are taken by short processes which project backward in the median line. The number of vertebræ bearing these stays varies greatly. In *Pæcilia vivipara* (Fig. 1) there are only two; in some forms

there are as many as five. In *Cnesterodon* there are none. In *Phallotorynus* there are three, the first and last are long and needle-like and the central one is expanded or club-shaped at the tip. Just before these there is a single short stay. Garman (*b*, Plate VIII) has figured many of the different species. The muscular mass enveloping the base of the anal is directly attached by a tough ligament to the vertebral column.

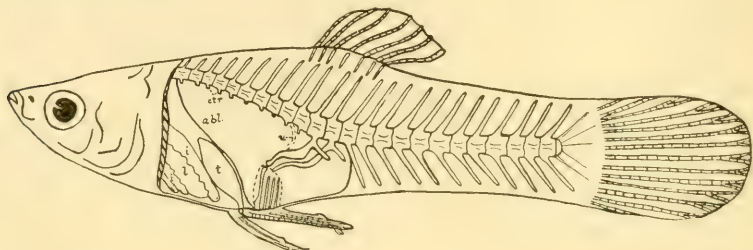


FIG. 1. Diagrammatic sketch of *Pæcilia vivipara*, ♂, showing modification of last two precaudal vertebræ to form a support for the intromittent organ. *i*, intestine; *l*, liver; *t*, testicle; *abl*, air-bladder; *u*, ureter; *ctr*, ends of ribs cut off to show abdominal cavity.

For the modified subvertebral processes Philippi (*d*, 1908) has proposed the term 'gonapophysis.' In *Pæcilia vivipara* (Fig. 1) the first of these processes joins directly with the enlarged first interhæmal. The other interhæmals or *radialia*, with which the rays of the anal fin are articulated, are sharp and slender, and all, including the first enlarged one, are enclosed in the mass of muscles, which controls the movements of the fin.

The forward position of the anal fin in the male causes the crowding of the viscera into the extreme forward end of the body-cavity. In females the development of young within the ovarian sack likewise causes a pushing of the viscera toward the head. In this sex the air bladder is a simple oval sack, but in males the development of the subvertebral stays causes a split in the organ, so that posteriorly it is bilobed, with the subvertebral processes occupying a position between the lobes.

#### BREEDING HABITS.

The act of copulation in the viviparous Pæciliids has not often been seen. Agassiz (1853, p. 135) witnessed it in *Mollienisia latipinna*, and in this manner learned that the two forms, which had previously



been considered members of different genera, were in reality male and female of the same species. He gave no details of the behavior of the two sexes.

Ryder (1885, p. 155) published a more detailed account of the actions of *Gambusia patruelis*, based on observations related to him by A. A. Duly, an employee of the National Museum. The head of the male was said to be turned in the direction of the tail of the female during coitus and the prolonged anal fin thrust into the external opening of the ovarian duct. This account, according to the observations of both Philippi and Seal, is entirely wrong.

Philippi had opportunity to see the copulation in both *P. caudomaculatus* and *C. decem-maculatus*. The habits of the two species are essentially alike. The anal fin of the male, which normally lies folded against the abdomen, is in breeding males suddenly thrust forward and somewhat sidewise. The male slowly follows the female, but maintains a certain distance, going through exactly the same motions as the female. In general the male swims somewhat under and behind the female. It suddenly darts upward toward the female, and with extraordinary speed places the tip of the anal bearing a sperm capsule upon the urogenital papilla of the female. With equal speed its course is continued and the anal is withdrawn into the usual position.

Seal (1911, p. 92) observed the breeding habits of *Gambusia holbrooki* and *Heterandria formosa*, which he kept in aquaria. The habits are said to be exactly alike. He says: "The male follows incessantly and warily after the female, on the left side and to the rear, the female frequently turning and making savage dives at him, causing him to turn and flee, but to return immediately and follow, watching for a moment when her attention will be distracted, when he will make a sudden dash, sometimes succeeding in inserting the intromittent organ into the genital pore, but oftener apparently missing, because of a quick turn of the female from which he flees in apparent terror. The contact is so sudden and brief that it required many observations to verify it. In these movements the male organ is thrust forward and to the right toward the female. In small jars the males are frequently killed, especially when the female is full sized, or if there are two or three females to one male. . . . There is never more than one male following a female. If others approach, the male turns and drives them off."



These accounts are in almost entire accord and are the most complete yet given. The manner of conducting the spermatozoa from the genital opening to the tip of the anal, however, is yet to be made known. In most of the viviparous forms, except *Fitzroyia* and *Anableps*, the genital duct of the male opens immediately in front of the base of the anal fin. In certain genera, such as *Pæcilia*, *Mollienisia*, *Limia*, and *Xiphophorus*, the ventral fins, which adjoin the anal, are elongated, and, if pressed against it, would form a tube extending nearly to the end of the anal, through which the spermatozoa might pass. In the majority of the viviparous genera, however, such as *Heterandria*, *Phalloceros*, and *Cnesterodon*, the ventral fins are altogether too small to be of such service. Further observations on living fishes will be necessary to determine the manner in which the sperm bodies are transferred to the tip of the anal. In *Fitzroyia* and *Anableps* the ureter and the sperm-duct continue to the end of the anal, which in this case is an actual tube.

Garman (a, p. 1012) observed that in *Anableps* the tip of the tubular anal of the male is invariably pointed either to the right or to the left. In females the genital orifice is protected by a large scale, which is fastened either on one side or the other, and permits the entrance of the anal of the male only from the opposite side. This Garman fancifully thought was a unique device to insure cross-fertilization. It is obvious that a male with the tip of the anal directed toward the *right* can mate only with a female having the *left* side of the genital orifice free through the fastening of the protective scale upon the right side. Garman thought that in the same brood probably all males and all females were of the same type of structure and that interbreeding would thus be prevented. In *Fitzroyia* the anal of the male is also tube-like and the direction of its tip is fixed. But since in this genus the genital orifice of the female is unprotected by a scale or otherwise, it seems probable that mating can be accomplished by either type of male with any female. There would thus be no provision to insure cross-fertilization in this genus.

Philippi observed that, although both sides of the anal are alike in *P. caudomaculatus* and *C. decem-maculatus*, the anal can in any one individual be used only on one side of the body. In *P. caudomaculatus* it is prevailing the left side, and in *C. decem-maculatus* the right, from which the anal may be thrust out. This it is presumed means that males of *C. decem-maculatus* approach the female from the left side,

and of *P. caudomaculatus* from the right. A variant is sometimes found which moves the anal on the side of the body opposite that which is characteristic of the species.

The males of *P. caudomaculatus* and *C. decem-maculatus* are, according to Philippi, sexually active throughout the year. In the aquarium they follow other specimens about continually, even though these are immature individuals of either sex. That this is not due to playful instincts, or to similar reasons, is shown by the constant folding and unfolding of the anal and the restless swimming up to the other fishes from below and behind, which are characteristic actions of breeding males. Females however show a definite rest-period, which in Berlin happens during the winter. At this time one of the females under observation sank to the bottom of the basin, where it remained surrounded by the waiting males, but free from their attacks, since these must rise upward from below in order to effect a transfer of the sperm.

#### AGGREGATIONS OF SPERM, OR "SPERMOZEUGMATA."

A slight pressure upon the abdominal wall of narcotized male fishes causes expulsion of the sexual products (Philippi). These consist of numerous milk-white bodies, which stick fast to the first available object. These collections of sperm are elliptical in shape and measure in *P. caudomaculatus* 122 microns in length and 73 microns in width; in *C. decem-maculatus* they are 220 microns long and 107 microns wide.

By fixation and staining with hæmatoxylin-eosin they are seen to consist of closely crowded spermatozoa, the long axes of which are perpendicular to the surface of the body. The heads of the spermatozoa lie at the periphery, while the center is composed of the tails and a few heads of spermatozoa. The whole mass is held together by a sticky substance, which is acquired in the lumen of the testicle. This sticky material probably causes the sperm-body to fasten to the genital papilla of the female. The entire outer portion of the genital tract of the breeding male is filled with these elliptical capsules. For similar aggregations of sperm in insects, which likewise lack an external investment, Ballowitz (1895, p. 458) has proposed the name "*spermozeugma*," plural "*spermozeugmata*."

Although the spermatozoa are ejaculated in the masses called spermozeugmata, the latter are never found in the oviduct. A number of these sperm-masses, immediately after being taken from the male,

were placed in normal salt solution, where they sank to the bottom. After eighteen hours the majority were unchanged; one had released a wisp of sperm, which remained about the otherwise unchanged mass, some showed softening, but very few had broken up. The following day the great majority were still unchanged, although somewhat swollen, and on the fourth day they still remained unchanged.

A number of these sperm-bodies were placed in a dish in which the ovary and genital tract of a freshly killed female had been crushed. Within a very short time (six minutes) after coming under the influence of the ovarian fluid these bodies had dissolved and the individual spermatozoa were set free.

A *receptaculum seminis* is formed by numerous unsymmetrical folds in the lining of the oviduct. Within these folds the spermatozoa are found in incredible numbers, and they remain here even after the birth of the young.

#### SUBSEQUENT FERTILIZATION FROM A SINGLE MATING.

Zolotnisky (1901, p. 65) observed that a female of *P. caudomaculatus*, which had been separated from males after the appearance of a brood of young, produced another within six weeks, and a third brood four weeks after this. This occurred, although copulation subsequent to the first parturition had not taken place. Philippi also isolated females at, or slightly before, parturition. In every instance the females became pregnant for a second time, and one specimen produced a third brood forty-six days after the appearance of the second. Poey noted these facts many years ago.

Many notices of "hybrids" among the viviparous species have appeared in the literature of fish-fanciers. These presumable hybrids have certainly arisen through the ability of bringing forth young without fertilization between broods. A female of one species, for example, which has borne young is placed with a male of another species. After some weeks young appear, which are taken for hybrids, but are in reality a product of the first mating. Actual hybrids can be obtained only by carefully rearing young fishes until discrimination of the sexes is possible. After this they must be kept rigidly separated, and the first mating of the young female must be made with a male of a different species. Unless this method has been practised, accounts of "hybrids" among these fishes are worthless.

## BIRTH.

In the two species, which Philippi had under observation, the young were born singly and at intervals of a few minutes. Delivery usually took place before eight o'clock in the morning, but in a few instances it took place about noon. During this period the female, when not tormented by males, remained just below the surface of the water. The young are not expelled in a definite position; either the head or the tail may appear first, and occasionally the young is expelled doubled upon itself. Delivery is much slower when the young appear tail first. In this case the adult may swim about for awhile with the half-protruding young. The position of the young in the ovary, as shown by cross-sections, is likewise undetermined.

Contrary to Ryder's statement that fright seemed to hasten parturition, Philippi found that excitement tended to greatly retard or postpone delivery. For better observation he placed females in the act of delivery in smaller aquaria. This usually caused a delay of four or five hours, and when parturition was resumed a number of unripe eggs were also cast out.

The cannibalistic habits of the fishes are pronounced, and when the birth is at an end the adult will seize upon her own young. This takes place even when the tank is well supplied with food. The males likewise devour the young fishes, and if they are to be reared, they must be separated from the adults.

Seal (1911, p. 93) states that the young of *Gambusia holbrooki* and *Heterandria formosa* are born one at a time. The ejection of each fish is so rapid that they appear as though shot out with some force. "This, however, might be due to the bursting of the follicle and the uncoiling of the fish as it is released from restraint. When they first appear they are still in a somewhat curved form, but they quickly straighten out and swim into hiding. . . . The intervals between the extrusions vary from several minutes to as many hours." Seal also noted the presence of two or more generations in a single season; fishes born early in May were themselves mature and producing young by the middle of August.

## NUMBER OF YOUNG IN SOME VIVIPAROUS SPECIES.

The number of young at birth in a given species is evidently quite variable. The appended table gives the number of embryos found in

females of various species. The ovaries have been dissected out and the number of young ascertained by carefully picking the ovary to pieces. In pregnancy the abdomen is greatly distended and the ovary fills a large part of the body-cavity. The ovary is exceedingly thin-walled, and as suggested by Ryder, the gravid follicles are hung together very much in the manner of a bunch of grapes. They are readily separable.

Species.	Size.	Date.	Locality.	Contents of ovary.
<i>P. vivipara</i> .....	55 mm.	April 14, 1908	Cachoeira, Bahia	34 small ova.
" "	.....71 mm.	" "	" "	111 small embryos, 3 small ova
" "	.....61 mm.	" "	" "	66 embryos, 2 ova.
" "	.....44 mm.	June 18, 1908	Munez Friere	32 ova.
" "	.....45 mm.	" "	" "	21 small embryos
<i>P. fria</i> .....	23 mm.	Aug. 11, 1913	Vinces, Ecuador	2 large embryos, 2 ova.
" "	.....27 mm.	" "	" "	4 large embryos, 6 small embryos, 3 ova.
" "	.....22 mm.	" "	" "	2 very large embryos, 1 small embryo.
" "	.....23 mm.	" "	" "	1 very large embryo, 1 small embryo, 3 ova.
" "	.....24 mm.	" "	" "	1 large embryo, 2 small embryos, 2 eggs.
<i>D. chocoënsis</i> .....	34 mm.	May 9, 1913	Chocó, Colombia	5 embryos, 8 ova.
<i>P. candomaculatus</i> ..	55 mm.	July 26, 1908	Raiz da Serra São Paulo	39 embryos
" "	..45 mm.	July 26, 1908	Raiz da Serra	25 ova.
" "	..42 mm.	July 25, 1908	Alto da Serra	Spent.
" "	..38 mm.	July 25, 1908	Alto da Serra	15 small ova.
<i>C. decemmaculatus</i> ..	38 mm.	Dec. 22, 1908	Serrinha Paran�, Rio Iguassu	16 embryos.
" "	..45 mm.	Dec. 22, 1908	Serrinha Paran�,	55 embryos.
" "	..39 mm.	Dec. 22, 1908	Serrinha Paran�,	28 embryos.
" "	..40 mm.	Dec. 22, 1908	Serrinha Paran�,	20 embryos.
" "	..36 mm.	Dec. 22, 1908	Serrinha Paran�,	31 embryos.
<i>Limia hollandi</i> .....	42 mm.	July 31, 1908	Rio Pil�o, S. Paulo,	24 embryos.



The ova are quite large, yellowish in appearance, and spherical, measuring on an average 1.5 mm. in diameter. In this list I have counted as ova those which show no differentiation. When development begins the optic vesicles early become pigmented, and are the first major indication of the initiation of development. Examination with a binocular microscope is sufficient to distinguish a small embryo from an undifferentiated egg.

It will be seen that the same females often contain both large and small embryos and undifferentiated ova. The latter are often quite small and the birth of the young which they are to produce will be postponed considerably after the birth of the larger ones. Specimens of *Diphyacantha chocoënsis*, which externally seemed pregnant and had evidently just been delivered of one brood, judging from the collapsed ovaries, still contained a few small embryos and ova. Similar conditions were found in specimens of *Pseudopæcilia fria*. These observations are to be correlated with the observations of Philippi, who noted successive births from a single mating. In other specimens it is common to find a few embryos considerably behind in development, when compared with the average. These probably are the result of later fertilization. The period in which delivery takes place is also variable, since in the same locality specimens are found with the contents of the ovary ranging in different examples all the way from small ova to embryos nearly ready for birth. Usually, when taken during the breeding season, all of the mature females from a given locality are pregnant. Occasionally, however, fully mature individuals contain neither ova nor embryos.

The presence in the ovary at the same time of both ova and embryos in one or two different stages of development seems to have previously been noticed by only one observer. E. G. Boulenger (1912, p. 906) remarked these facts in *Lebistes reticulatus*, but there is no indication that his observations were based on actual dissection of the ovary. He says, "As breeding goes on all through the year, at least in captivity, the female is in an almost permanently pregnant condition, and within a fortnight of having brought forth a brood (such a period representing the duration of the gestation, at a temperature of over 70°) once more brings a generation into the world. It should be borne in mind, however, that a single impregnation is sufficient for the fertilization of several broods, the embryos of the second and third generation being already in an advanced condition when the first young are born."



## THE SEX RATIO.

The general predominance of females in collections of viviparous Pœciliids has been repeatedly noticed by students of these fishes. The bright colors of the males and structure of the anal fin make the discrimination of the sexes in mature examples an easy matter. Garman (1895, p. 7), after observation of numbers of specimens, was impelled to say, "By common experience collectors find males to be less numerous than females. The striking appearance of the male will no doubt be claimed as evidence of selection, because of a possible benefit in enabling the female more readily to find him; it may also be utilized in explaining the discrepancy in numbers, since it must be effectual in making him an object of more prominence and a more frequent prey than the other sex for enemies of the species."

Most writers are inclined to attribute the discrepancy in numbers of the two sexes to the much smaller size of the male, which causes it to be overlooked by collectors and also enables it to escape through the meshes of seines, which readily hold the bulkier females. From a study of the Haseman collections I observed that in nearly every species the number of females is more than double that of the males.

I have carefully examined all of the specimens in a pint of *Lebistes reticulatus* taken under Dr. Eigenmann's direction in the Barbadoes. This collection was taken with a very finely meshed net and represents the conditions actually found in nature, since it includes specimens of minute water-insects, plant-rootlets, and other things. Many fishes, not larger than five millimeters, have been included and it is quite evident that few went through the seine. This lot comprises 2,070 specimens, of which 520 are males, 630 are females, and 920 are too small to be determined. The latter average about eight or ten millimeters; when that stage has been passed it becomes easier to distinguish the sexes. Males then exhibit the characteristic markings, the anal fin becomes advanced and modified, and full maturity is reached when the male is about fifteen millimeters in length. Females are much larger and may reach a length of from twenty-five to thirty millimeters. It is quite certain that this count of males includes only members of that sex, while a few of the smaller specimens regarded as females may really have been immature males. It will thus be seen that the sex ratio, when an adequate collection is at hand, does not materially differ from that found in other fishes. Mr. Edward

G. Boulenger (1912, p. 906), who has reared this species, likewise notes the equality of sexes in very small broods; a fact, however, which in the prevailing idea of the numerical inequality of the sexes he considers remarkable.

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## GENERA AND SPECIES OF PÆCILIIDÆ.

## Genus RIVULUS Poey.

*Rivulus* POEY, Memorias sobre la Historia Natural de Cuba, II, 1858, 307, 383;  
 GARMAN, Mem. Mus. Comp. Zoöl., XIX, 1, 1905, p. 134; REGAN, Ann. Mag.  
 Nat. Hist., (8), X, 1912, p. 495.

Type, *Rivulus cylindraceus* Poey.

Small, usually depressed, oviparous fishes, in which the margins of the eyes are not free and the gill-membranes are separate and free from the isthmus. Dorsal smaller than the anal and placed much farther back. The sexes do not differ, except that the female is generally brighter and usually has a caudal ocellus.

Teeth in each jaw, an outer series of sharp, recurved canines, with several rows of minute teeth behind them.

1. *Rivulus cylindraceus* Poey.

5812 *a*, C. M. 35 mm. Los Indios, Isle of Pines. Gustav Link.

2. *Rivulus hartii* (Boulenger).

*Haplochilus hartii* BOULENGER, Ann. Mag. Nat. Hist., (6), VI, 1890, p. 190; REGAN, Proc. Zoöl. Soc. London, 1906, I, p. 389, pl. XXI, fig. 2.

*Rivulus hartii* REGAN, Ann. Mag. Nat. Hist., (8), X, 1912, p. 501.

13608, I. U. M. Three, 25-46 mm. Quebrada Cramalote, Villavicencio, Colombia. Gonzales.

13609, I. U. M. Two, 23-47 mm. Barrigona, Rio Meta. Gonzales.

These specimens are provisionally placed here. D. 8-9; A. 12, 13, 14 and 15; lat. l. 38-40. They resemble *R. hartii*, but the caudal is rounded and without a black margin.

3. *Rivulus elegans* Steindachner.

*Rivulus elegans* STEINDACHNER, Denkschr. Akad. Wissen. Wien, XLII, 1880, p. 85, pl. VI, fig. 6; REGAN, Ann. Mag. Nat. Hist., (8), X, 1912, p. 498 (Rio Condoto, Colombia); *ibid.*, 1913, p. 471.

5810 *a-d*, C. M.; 13601 I. U. M. Twelve, 23-45 mm. Rio Condoto, Colombia. Wilson.

5811 *a-i*, C. M.; 13602 I. U. M. Twenty three, 17-31 mm. Rio Truando. Wilson.

Head 4-4.2; depth 5; depth of caudal peduncle 7.5-8 in length to base of caudal and 2 in head. Eye 3.5 in head and 1.5 in interorbital.

D.  $\frac{7}{13}$ ,  $\frac{8}{1}$ ; A.  $\frac{12}{3}$ ,  $\frac{13}{11}$ ,  $\frac{14}{1}$  (the denominator represents the number of individuals); scales 33-37 in a lateral series, 9 in transverse series.

Origin of dorsal over last three rays of anal, about twice as distant from the operculum as from the base of the caudal, its height equal to the length of the pectoral. Origin of anal slightly nearer operculum than base of caudal. Ventrals small, equidistant from tip of snout and base of caudal; their length equal to the diameter of the eye.

General coloration of males (specimens from Condoto) light olivaceous, center of each scale lighter, their edges forming longitudinal stripes, belly whitish. Top of head dusky, an oblong dark spot underlying the operculum. All fins dusky, unspotted; anal with a clear whitish border at the base, becoming darker outwardly, it and the lower caudal margin edged with deep black. In females the dark longitudinal stripes are broken by light patches, which form transverse oblong blotches. The dorsal and caudal fins are heavily spotted and the anal more lightly. In none of the specimens from the Rio Condoto is there a caudal ocellus. In the specimens from the Rio Truando almost half of the females possess a distinct caudal fleck and are much darker.

*Rivulus godmani* Regan, of which I have examined numerous specimens, recorded as *R. elegans* by Miller (*Bull. American Mus. Nat. Hist.*, Vol. XXIII, 1907, p. 104) from Los Amates, Guatemala, seems only to differ from *R. elegans* in having the dark edge of the lower caudal lobe of the males broadened to form an intramarginal stripe with a pale lower margin.

#### 4. *Rivulus magdalenæ* Eigenmann & Henn, sp. nov.

- 5813, C. M. Type, 56 mm. 5814 *a-m*, C. M.; 13603 I. U. M., twenty-five paratypes, 24-62 mm. Ibagué, (elevation 4,250 ft.). 5815 *a-h*, C. M.; 13604 I. U. M., fifteen, 20-45 mm., Rio Guaduas, Dept. of Cundinamarca. Gonzales.
- 5816 *a-b*, C. M.; 13605 I. U. M., four, 25-46 mm. Rio Villeta. Gonzales.
- 5817 *a-h*, C. M.; 13606 I. U. M., fifteen, 20-42 mm. Quebrada de Chamisal. Gonzales.
- 5818 *a-b*, C. M., two small specimens, 11-15 mm., probably belong here. Boquia. Eigenmann.

All of these localities except Boquia, which is in the Cauca basin west of the central Cordilleras, are in the highlands of the Magdalena Basin, west of Bogotá.

Very similar in proportions to *R. elegans*, differing in the smaller scales and in coloration.

Head 3.8-4; depth 5-5.2; caudal peduncle 7-8 in length and 2 in the head. Eye 3 in head; 1.5 in interorbital. D. 9-11; A. 15-16; scales 40-42 in lateral series, 9 in transverse series.

Origin of dorsal twice as distant from the point a snout-length behind the eye as from the base of the caudal, or about two head-lengths behind the operculum. Other fins as in *R. elegans*, except that the caudal is sub-truncate, not oval or rounded.

Olivaceous, streaked and blotched with dark brown. Dorsal and caudal streaked with the same color. Operculum underlaid with blackish. A series of heavy vertical purplish blotches in the mid-lateral line. Females have a circular caudal ocellus surrounded by a white margin. Males have the tip of the anal and both caudal edges margined with black.

#### 5. *Rivulus waimacui* Eigenmann.

Regan (Ann. Mag. Nat. Hist., (8), X, 1912, p. 497) regards *Rivulus waimacui* Eigenmann as synonymous with *R. holmiæ* Eigenmann. These species while similar are, however, distinct. The distinguishing characters are sufficiently indicated in the key accompanying the original descriptions while other points are:

- a. Origin of dorsal about two, or less than two and one-half, head-lengths behind the operculum; D. 8-9; A. 16; scales in lateral series forty-three or forty-four, with about three on the base of the caudal; a median predorsal series of about twenty-seven scales; this series is discontinued five or six scales before the dorsal, where those of the two sides dovetail or overlap the median line; females with a caudal ocellus.....*R. holmiæ*.
- aa. Origin of dorsal two and one-half, or more, head-lengths behind operculum; D. 8; A. 14; scales in lateral series forty-seven to fifty, with three or four on base of caudal; a regular median series of thirty-three to thirty-eight scales between occiput and dorsal; females without a caudal ocellus...*R. waimacui*.

#### 6. *Rivulus urophthalmus* Günther.

*Rivulus urophthalmus* GÜNTHER, Cat. Fishes, Brit. Mus., VI., 1866, p. 327; REGAN, Ann. Mag. Nat. Hist., (8), X, 1912, p. 498.

4631, C. M. Eight, 24-33 mm., Alagoinhas, Rio Catu, Bahia. Hase-man.



4632, C. M. Ten, 23-43 mm. Raiz da Serra, São Paulo. Haseman.

4633, C. M. Six, 27-45 mm. Cubatão, Rio Cubatão, São Paulo. Haseman.

5821, C. M. Two, 52-56 mm., Iguape, Rio Ribeira da Iguape. Haseman.

7. *Rivulus obscurus* Garman.

*Rivulus obscurus* GARMAN, Mem. Mus. Comp. Zool., XIX, 1895, p. 140; PELLEGRIN, Bull. Mus. d'Hist. Nat. Paris, 1899, p. 157, (Rio Spuié); REGAN, Ann. Mag. Nat. Hist., (8), X, 1912, p. 502.

5820, C. M. Four specimens, 27-30 mm. Manãos. Haseman.

D. 5, A. 7, lat. l. 29 in 2 specimens; D. 5, A. 8, lat. l. 29 in another, and D. 6, A. 9, lat. l. 30 in the last. These agree in all respects with the original description, except that the dorsal is completely posterior to the anal.

8. *Rivulus punctatus* Boulenger.

*Rivulus punctatus* BOULENGER, Boll. Mus. Torino, X, No. 196, 1895, p. 3 (Colonia Risso); EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 430; EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 454.

\* 4625, C. M. Two, 16 and 22 mm. Villa Hays, Paraguay. Haseman.

4626, C. M. Nine, 14-30 mm., Urucum Mts., Corumbá, Matto Grosso. Haseman.

4627, C. M. One, 24 mm. Puerto Suarez, Bolivia. Haseman.

4628, C. M. One, 22 mm., Rio Santa Rita, into Rio Paraguay, Matto Grosso. Haseman.

With these is probably to be included, 4629, C. M., a specimen 22 mm. long from the Rio Boa Ventura, Matto Grosso of the Rio Guaporé.

These specimens agree very well with the description of Boulenger D. 5-6; A. 11; P. 10; V. 5; lat. l. 30-31; 9 transverse series of scales.

Head 4, depth at anal origin 7; caudal peduncle 10. Finely spotted; caudal with a number of cross-bars.

9. *Rivulus compressus* Henn, sp. nov. (Plate XVIII, fig. 1.)

5819, C. M. Type, unique, 55 mm. Manãos, Nov. 30, 1909. Haseman.

This may be *R. micropus* Steindachner, but it seems to differ in the more forward position of the dorsal, the longer head, etc.

Head 4; depth 5.2; caudal peduncle 8 in the length; 2 in head. Eye





3.5 in head, 1.5 in interorbital and equal to the snout. D. 7; A. 14; 42 scales in horizontal series, 8 between dorsal and anal.

Head broader than deep. Very much compressed posteriorly, greatly depressed anteriorly, width of fish at ventrals one-half its width at the occiput. Profile slightly arched, cleft of mouth horizontal.

Origin of dorsal three times as distant from the tip of the snout as from the base of the caudal, inserted over the last anal ray. Origin of anal equidistant from operculum and base of caudal, ventrals equidistant from tip of snout and base of caudal, one and one-half as long as eye.

Coloration olivaceous, a narrow brown stripe between the rows of scales. Top of head and dorsal ridge darker.

#### 10. *Rivulus brevis* Regan.

*Rivulus brevis* REGAN, Ann. Mag. Nat. Hist., (8), X, 1912, p. 504 (Colombia).

University of Michigan, ten specimens, 26-45 mm., from Fundación, near Santa Marta, Dept. of the Magdalena, Colombia.

Much deeper and more compressed than most of the species of this genus. Head deeper than broad in mature examples; in young, as broad as deep.

Head 3.3-3.5; depth at origin of ventrals 3.5-3.8; depth of caudal peduncle 5.5-6 in length and 1.6 in head. Eye 3 in head, slightly less than interorbital. Width of the head 1.5 in the depth, which is 1.5 in the length. D. 8-9; A. 12-13; scales 29-30 in a lateral series, 8 or 9 in transverse series.

Origin of dorsal twice as distant from the anterior margin of the orbit as from the base of the caudal. Dorsal rises over the middle of the anal. In adult specimens the rays of all the fins are prolonged. The eighth to the eleventh rays of the anal are extended to form a streamer, which reaches to the base of the lower caudal fulcrum. Dorsal rays also prolonged. Middle rays of pectoral prolonged and reaching almost to middle of ventrals, which are extended on to the base of the anal. Caudal rays elongated, lowest rays often forming a streamer, basal third with a heavy sheath of small scales. All fins blackish.

#### Genus *GAMBUSIA* Poey.

*Gambusia* POEY, Memorias de Cuba, I, 1855, p. 382; Regan, Proc. Zool. Soc. London, 1913, p. 981.

11. *Gambusia caliensis* Eigenmann & Henn, sp. nov.

6700 a, C. M. Type, ♀, 34 mm., length to base of caudal 28 mm.

Cali, Colombia. Eigenmann.

6700 b, C. M. An immature specimen, 16 mm. From the same locality.

In the absence of adult males the generic affinities of this species are, of course, uncertain. It has the mouth and dentition of *Gambusia*.

Head 4.6; equal to the depth at the origin of the anal; depth of caudal peduncle 7 in the length. Eye 3 in head; 1.5 in interorbital; snout 1.5 in eye. D. 9; A. 10; P. 10; V. 6; 30 scales in a lateral series with 2 on the base of the caudal; 7 in transverse series. There is a median predorsal series of twelve scales; this series ceases within four scales of the dorsal, where the rows of scales of the sides overlap. Dorsal profile rising or curved to the middle of the total length, then dipping to the dorsal; ventral profile much less curved.

Origin of dorsal equidistant from the tip of the caudal and the posterior margin of the orbit, or 1.6 times as distant from the anterior margin of the orbit as from the base of the caudal. Dorsal inserted over the last ray of the anal. Origin of anal about equidistant from base of caudal and posterior margin of orbit.

General coloration olivaceous, top of head and operculum darker. Outlines of scales broadly margined with chromatophores. A faint series of dusky, transverse bars. In the type, a pregnant female, the abdomen is distended and underlaid with purplish black.

Genus *DIPHYACANTHA*<sup>4</sup> Henn, gen. nov.

Teeth, very similar to those of *Gambusia*, *i. e.*, an outer widely spaced series of conical teeth; in immediate conjunction an inner series of small, closely set, similar teeth.

Anal in the males an elongate organ, equal in length to one-third of the total length of the fish. The terminal portion of this intermittent organ resembles that of *Pæcilia* and *Pseudopæcilia*; it differs from these and other genera in the character of the first prolonged ray, which lacks a prepuce, bears both dorsally and ventrally a subterminal series of retrorse hooks, and terminates in a single appendage or finger-like process. This, while much smaller, is median and unpaired, as in *Cnesterodon*.

<sup>4</sup> διφύης = twofold; ἀκανθα, ἦ = a spine, with reference to the bipartite structure of the hooked segments in the first prolonged ray of the male anal.

In females the ventrals are normal in shape and barely reach the vent. In males the ventrals, although proportionately of the same size, are slightly more lanceolate and are set more closely to the anal, which they overlap for a third of their length.

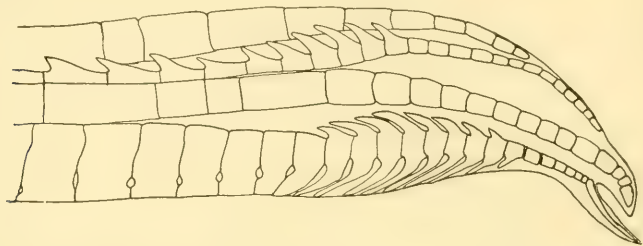


FIG. 2. *Diphyacantha chocoënsis* Henn. Distal end of intromittent organ.  $\times \frac{40}{1}$ .  
No. 13,620, I. U. M. Rio Calima, Colombia.

12. ***Diphyacantha chocoënsis*** Henn. sp. nov. (Plate XIX, figs. 1 and 2.)

13618, I. U. M., **Type**, male, 31 mm. 13619, I. U. M.; 5825 *a-j*,

C. M., **Paratypes**, twenty-five specimens, four males, twenty-one females, 18–35 mm. Small creek near mouth of Rio Calima, a tributary of the lower San Juan, Chocó, Colombia. Henn.

13620, I. U. M. Two males, four females, 22–37 mm. Rio Calima, small brushy creek near Boca del Guineo. Henn.

Head 3.8–4.2; depth at origin of anal, in females 4–4.2, in males 3.8; depth of caudal peduncle 6.5–7 in length without caudal and about 1.3 in head. Eye 2.5 in head; 1.5 in interorbital. Premaxillary very short, mandible longer, forming anterior border of mouth, chin steep and oblique, cleft of mouth almost vertical. Upper profile almost *horizontal*, lower gently curved.

D. 7; A. 10 (in 12 specimens); P. 12–13; V. 6; scales 28 in a lateral series, which is underlaid by a black canal; 7 in transverse series, exclusive of median dorsal series; 16–18 scales between the large occipital scale and the origin of the dorsal, predorsal region very broad and flat.

Origin of dorsal far back in both sexes, twice as distant from the anterior margin of the orbit as from the base of the caudal, or equidistant from the posterior margin of the orbit and the tip of the caudal. Origin of anal in females equidistant from base of caudal, and upper angle of gill-opening, slightly less in length than the head. In males

the origin of the anal is very slightly nearer the tip of the snout than the base of the caudal. Its length is one-third that of the entire length of the fish. Pectorals nearly equal to the head, caudal rounded or oval.

Olivaceous, margins of each scale outlined with chromatophores. Coloration more or less even throughout, except the belly, which is white or colorless. Occiput chocolate-brown; a narrow median line to dorsal, a similar line on the ventral keel of the caudal peduncle. Operculum underlaid with silvery. In specimens less than 25 mm., there are about ten, or fewer, narrow, indistinct, vertical lines of darker, distributed between the head and caudal. All mature females have a very conspicuous black area surrounding the vent. All of the fins are colorless.

Genus PRIAPICHTHYS Regan.

*Priapichthys* REGAN, Proc. Zool. Soc. London, 1913, p. 991, text-fig. 170 B.

**Type**, *Gambusia annectens* Regan.

13. *Priapichthys nigroventralis* (Eigenmann & Henn.)

*Gambusia nigroventralis* EIGENMANN & HENN, Indiana Univ. Studies, No. 16, 1912, p. 26. (Rio San Juan at Istmina.)

*Priapichthys nigroventralis* REGAN, Proc. Zool. Soc. London, 1913, p. 992.

*Gambusia caudovittata* REGAN, Ann. Mag. Nat. Hist., (8), XII, 1913, p. 471 (Rio Condoto of San Juan); Proc. Zool. Soc. London, 1913, p. 986.

4835 a, C. M., **Type**, 4835 a-e, C. M.; 12689 a-f, I. U. M., **paratypes**. Istmina. Eigenmann.

6697 a-g, C. M.; 13613 I. U. M. Fifteen, four males, eleven females, 15-25 mm. Tambo. C. E. Wilson.

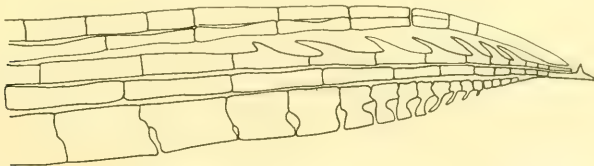


FIG. 3. *Priapichthys nigroventralis* (Eigenmann & Henn). Distal end of intromittent organ.  $\times \frac{40}{1}$ . No. 12,689, I. U. M. Istmina, Colombia.

13614, I. U. M. Four small specimens, 10-20 mm. Manigru. Wilson.

13615, I. U. M. One male, 21 mm. Quibdo. Wilson.

6698 a-g, C. M.; 13616 I. U. M. Fifteen, seven males, eight females, 15-22 mm. Raspadura. Wilson.

6701 *a*, C. M. A single specimen. 15 mm. Rio Calima. Henn.

A brightly colored, small species, resembling *P. episcopi* (Steindachner) in the heavily pigmented anal, but having the sides of a uniform color and lacking the series of lateral spots. Basal fourth of the dorsal in the male with a heavily pigmented band, middle portion clear, outer third again pigmented. Outer portion of caudal in both sexes broadly banded with dusky.

This species occurs in the Rio Atrato and in the Rio San Juan.

#### Genus HETERANDRIA Agassiz.

*Heterandria* AGASSIZ, American Journal of Science, (2) Vol. XVI, 1853, p. 135.

In this genus the length of the male intromittent organ is about one-third of the entire length. The ventrals are minute, thoracic, and barely reach to the base of the anal.

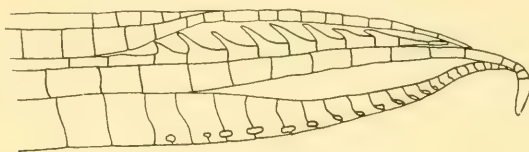


FIG. 4. *Heterandria formosa* Agassiz. Distal end of intromittent organ.  $\times \frac{40}{1}$ .  
No. 6846, I. U. M. Jacksonville, Florida.

The third or first prolonged ray of the anal of the male has the distal portion club-shaped, without serrations or hooks, the fourth ray ends in an antrorse point, the fifth ray bears dorsally a series of retrorse hooks, the sixth and seventh rays unite terminally to form the dorsal margin of the fin.

As restricted by Regan, (P. Z. S., 1913, p. 995) this genus includes the type, *H. formosa* Agassiz, ranging from the Carolinas to Florida, and *H. fasciata* (Meek) from southern Mexico. The males of the latter species have not been described.

#### 14. *Heterandria hasemani* Henn, sp. nov. (Plate XX, fig. 1.)

4663, C. M., **type**, a female, probably immature, 20 mm. 4664 *a-c*, C. M., **paratypes**, three females, 19–23 mm. Puerto Suarez, Bolivia (Paraguay Basin) May 7, 1909. Haseman.

The limited number of specimens and the lack of males, makes the generic reference doubtful. The teeth are spike-like, in several series,



and resemble those of *Heterandria formosa* Agassiz, which is the type of the genus. It is improbable that the genus *Heterandria* extends so far south, and this species may possibly be a member of *Pamphorichthys* Regan.

Head 4; depth at origin of dorsal 5.3; depth of caudal peduncle 8 in length; caudal peduncle twice in head; D. 6-7; A. 7-8; P. 9; V. 6; 27 scales in horizontal or lateral series; 7 in transverse series. The eye is rather large, 2.3 in length of head, and is equal to the interorbital width.

Body rather elongate. Origin of the dorsal about opposite to that of the anal and slightly in advance of the middle of the entire length. Fins only slightly pigmented. Pectorals reach over the middle of the ventrals, which are lanceolate, and have the middle rays longest, reaching to base of anal. Caudal rounded.

Lateral line a conspicuous black canal from the ninth scale backward. Above the lateral line the outlines of the scales are distinctly margined with dark brown chromatophores; below the lateral line these are lighter. The dark peritoneum gives a bluish appearance to the visceral cavity.

I name the species for Mr. John D. Haseman, to whose energy and zeal as a collector is to be attributed the greater portion of the collection upon which this paper is based.

#### Genus NEOHETERANDRIA Henn, gen. nov.

Intermediate between *Heterandria* and *Pseudopæcilia*.

The dentition consists of an outer series of widely spaced, long, recurved, conical teeth, with slightly expanded tips and an inner series of small, spike-like teeth in a narrow band.



FIG. 5. *Neoheterandria elegans* Henn. Distal end of intromittent organ.  $\times \frac{40}{1}$ .  
No. 5824, Carnegie Museum. Rio Truando.

Modified anal of the male, a narrow, moderately long organ with a bluntly rounded tip. First and second rays minute; third to seventh rays prolonged and modified. Third ray with a few recurved hooks



on the ventral surface near its tip. Fourth ray tapering and terminating in an abrupt downward hook. The fifth ray bears dorsally and terminally a series of four retrorse hooks and two rudiments.

15. *Neoheterandria elegans* Henn, sp. nov. (Plate XIX, figs. 4 and 5.)  
5823 a, C. M., **type**, a male, 16.5 mm. **Paratypes**, 5824 a-g, C. M.

One male, 15 mm., six females, 14-16 mm.; 13612, I. U. M. Two males, 14-16 mm., six females, 14-18 mm. Rio Truando, a tributary of the Lower Atrato, in Colombia. Charles E. Wilson.

An exceedingly minute fish, greatly resembling *Heterandria formosa* in size, coloration, and general appearance. Its small size makes an accurate description difficult.

Head 4; depth at origin of anal in females 4.5, in males about 4-4.5; depth of caudal peduncle 6-7 in length to base of caudal. Eye large, about 2.3 in head and slightly less than interorbital. Snout short, 1.3 in eye. Cleft of mouth vertical, lower jaw the longer.

D. 8; A. 10; scales 28 in longitudinal series, about 8 in transverse.

Origin of dorsal over last ray of anal in females, equidistant from the base of caudal and upper angle of gill-opening. Origin of anal in females equidistant from the base of the caudal and the center of the eye. The long modified anal of the male arises at the anterior third of the total length and is about equal in length to one-third of the length of the fish. The ventrals of males are minute and thoracic and barely reach to the base of the anal.

Coloration, similar to that of *Heterandria formosa*, in having a series of from six to nine vertical bars, beginning just posterior to the visceral cavity, differing from *formosa* in having the second bar above the center of the anal in females (above the ends of the posterior anal rays in males) broadened to form a conspicuous vertically oval black spot. Dorsal and anal barred or banded with blackish.

None of the females are pregnant. They may not be mature.

#### Genus PSEUDOPÆCILIA Regan.

*Pseudopæcilia* REGAN, Proc. Zool. Soc. London, 1913, p. 995, text-fig. 170 F.

Type, *Pæcilia festa* Boulenger.

This genus is very closely related to *Heterandria* and is in reality connected with that genus through *Neoheterandria*.

The dentition consists of an outer series of widely spaced, broadened, or expanded, incisors with recurved pointed tips, and an inner series of

much smaller spike-like teeth. In dentition, *Pseudopæcilia*, although having much heavier teeth, more closely resembles *Neoheterandria* than it does *Heterandria*.

The anal of the male is an elongate organ with a decurved tip, equalling in length about two-fifths of the length of the fish. The ventrals are minute and unmodified. The anal in males is inserted at about the second fifth of the entire length.

Another character, possibly peculiar to this genus, is the series of large pores about the margin of the pre-operculum.

#### 16. *Pseudopæcilia festæ* (Boulenger).

*Pæcilia festæ* BOULENGER, Boll. Mus. Zoöl. Torino, XIII, 1898, No. 329, p. 13, (San Vicente, near Santa Elena, Ecuador).

*Pseudopæcilia festæ* REGAN, Proc. Zoöl. Soc. London, 1913, p. 996.

No specimens of this species were secured.

#### 17. *Pseudopæcilia fria* (Eigenmann & Henn).

*Pæcilia fria* Eigenmann & Henn. Indiana Univ. Studies, No. 19, Jan. 16, 1914, p. 13 (Vinces, Ecuador).

This species may be identical with the preceding, but seems to differ in the number of scales. It has scales 3-29 or 30-4 (to ventrals). *P. festæ* is said to have 33-35 scales in a longitudinal series and 12-13 in a transverse series.

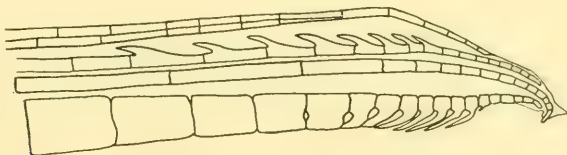


FIG. 6. *Pseudopæcilia fria* (Eigenmann & Henn). Distal end of intramittent organ.  $\times \frac{40}{1}$ . No. 13,107, I. U. M. Vincés, Ecuador.

The anal fins show slight differences which may be specific. Regan's figure of the anal of the male of *P. festæ* shows nine or more hooks on the third prolonged ray. In all of six examples of *P. fria* examined for this character, the number of these spines is eight.

#### Genus POECILIOPSIS Regan.

*Pæciliopsis* REGAN, Proc. Zoöl. Soc. London, 1913, p. 996, text fig. 170 D.

Type, *Pæcilia presidionis* Jordan and Culver.

18. *Pæciliopsis amates* (Miller).

*Pæcilia amates* MILLER, Bull. Am. Mus. Nat. Hist., XXIII, 1907, p. 108, fig. 1 (Los Amates, Guatemala).

This is a valid species of the genus *Pæciliopsis* as shown by the structure of the anal fin of the male. (Cf. Fig. 7.) *Pæciliopsis piltieri* (Meek); Field Mus. Pubs. Zool., X, 1912, p. 71, from La Junta, Costa

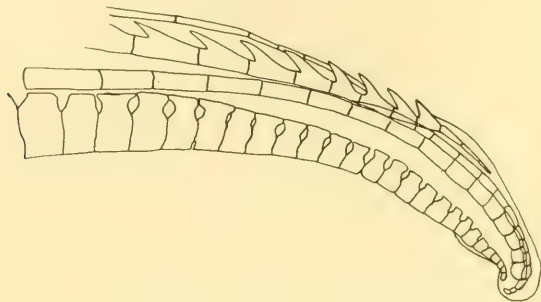


FIG. 7. *Pæciliopsis amates* (Miller). Distal end of intromittent organ.  $\times \frac{40}{1}$ , No. 11,375, I. U. M. Los Amates, Guatemala.

Rica, may be identical with this species. These two and the following species are the only members of the genus with distinct cross-bars or color-bands, which in most cases are confined to the male.

19. *Pæciliopsis colombiana* (Eigenmann & Henn.).

*Heterandria colombianus* EIGENMANN & HENN, Indiana Univ. Studies, No. 16; 1912, p. 27 (Rio Dagua, Colombia); REGAN, Proc. Zool. Soc. London, 1913, p. 996.

This well-marked species is different in coloration from the other members of the genus. The distinct chocolate streaks extend the full height of the fish, are widely spaced, and are equally distinct in both sexes.

## Genus PHALLOPTYCHUS Eigenmann.

*Phalloptychus* EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 430, fig. 6. REGAN, Proc. Zool. Soc. London, 1913, p. 999.

Type by original designation *Girardinus januaris* Hensel.

The dentition consists of an outer series of compressed, slightly recurved, spoon-oar-shaped teeth, with a broad band of minute, club-shaped teeth immediately behind them.

Anal of the male, when folded, *i. e.*, in the normal state, a long, needle-

like intromittent organ, contained 2.2 to 2.3 in the entire length. It is inserted forward of the anterior third of the entire length. Ventrals anterior to the origin of the anal, minute; rays not modified. Male elongate, greatest depth about 5 in length to base of caudal. Eigenmann, *loc. cit.*, p. 430, fig. 6, gives excellent figures of the male anal fins.

First and second anal rays of the male, minute; third, fourth, and fifth greatly prolonged. In the normal folded position, these lie closely apposed, forming a simple needle-shaped organ. Distal part of third ray club-shaped, near the tip free from the fourth, which tapers evenly and bears dorsally a series of strong, retrorse hooks. These lie downward or enclose the folded organ. Fifth ray heavy and tubular, closely joined to the fourth. Other rays much shorter. *Cnesterodon* differs from this genus in the presence of a long terminal hook.

KEY TO THE SPECIES OF PHALLOPTYCHUS.

a. D. 8; A. 9; V. 6; depth 4; vertical bands usually nine or fewer.

1. *eigenmanni* Henn.

aa. D. 9; A. 10; V. 5; depth 3.5, vertical bands usually more than nine.

2. *januarius* (Hensel).

20. *Phalloptychus eigenmanni* Henn, sp. nov. (Plate XX, figs. 2 and 3.) 4665 C. M., **type**, female, 29 mm. 4666, C. M., **paratypes**, two males, 20–22 mm.; eight females, 25–30 mm. Alagoinhas, Rio Catu, Bahia. March 4, 1908. Haseman.

D. 8; A. 9; P. 10; V. 6; head 4; equal to depth at origin of anal; caudal peduncle 6 in length to base of caudal and 1.5 in head. Eye 3 in head; 2 in caudal peduncle and equal to the interorbital width. Scales 27–29 in lateral series, 8 in transverse series. Snout short, 1.3 in eye; chin steep.

Distance from tip of snout to origin of dorsal, slightly less than distance from anal origin to tip of middle caudal rays. Dorsal origin over last rays of anal. Pectorals as long as the head minus the snout; ventrals just reaching the vent. Caudal elongate, rounded.

A series of from seven to nine vertical bands of color adorn the sides. The last two are often united to form a trident. Peritoneum silvery; color-bands absent over the visceral cavity.

This species differs from *P. januarius* (Hensel) in the more elongate form, smaller dorsal and anal, larger ventrals, and the fewer color-bands.

Named in honor of my respected professor, Dr. C. H. Eigenmann.

21. *Phalloptychus januarius* (Hensel).

- Girardinus januarius* HENSEL, Arch. für Naturgesch., XXXIV, 1868, p. 360; *ibid.*, XXXVI, 1870; EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 65; VON IHERING, Süßwasserf. v. Rio Grande do Sul, 1893, p. 28; STEINDACHNER, Sb. Akad. Wiss. Wien, CXVI, 1907, p. 492.
- Pæcilia januarius* EIGENMANN, Ann. N. Y. Acad. Sci., VII, 1894, p. 636.
- Glaridodon januarius* BERG, Anales Mus. Nac. Buenos Aires, V, 1897, p. 289 (in part).
- Phalloptychus januarius* EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 431; Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 458; REGAN, Proc. Zool. Soc. London, 1913, p. 999, Pl. C., figs. 7, 8 and text fig. 171 A.
- Girardinus iheringii* BOULENGER, Ann. Mag. Nat. Hist., Oct., 1889, p. 266; EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 65.
- ? *Gambusia gracilis* PERUGIA, Ann. Mus. Civ. Stor. Nat. Genova., X, (2), 1891, p. 652.

*Range:* Santa Catharina, Rio Grande do Sul, and Uruguay.

D. 9; A. 10; P. 10; V. 5; head 3.8-4; equal to from .82-.87 of the depth at the origin of the anal; this depth 3.1-3.6 in length to base of caudal; caudal peduncle 6.4-6.7 in length and 1.5-1.7 in head. Eye 3.5 in head; 2 in caudal peduncle; equal to interorbital. Scales 29 in lateral series, 8 in transverse series.

The vertical color-bands in this species are narrower and more numerous than in the preceding. They vary in number from nine to twelve.

No specimens were secured by Mr. Haseman. This description is based upon adult females from Rio Grande do Sul, received from Dr. H. von Ihering (Ind. Univ. Mus. No. 4899).

This species has been confused by Garman<sup>5</sup> and others following him, with *Girardinus caudomaculatus* Hensel (*Phalloceros*). Garman considered the two to be identical, and, since *Girardinus januarius* Hensel stood first in pagination, *G. caudomaculatus* should have become a synonym of *G. januarius*. Garman placed *G. januarius* in his new genus *Glaridodon*, with *Girardinus uninotatus* Poey of Cuba as the type. *Glaridodon* was later shown to be pre-occupied and replaced by Garman<sup>6</sup> with *Glaridichthys*. It is quite evident from Garman's figure of a male of "*Glaridodon januarius*" (Plate VIII, fig. 15) showing the antler-like processes, that his specimens were not this species, but were *G. caudomaculatus*.

<sup>5</sup> The Cyprinodonts, Mem. Mus. Comp. Zoöl., XIX, No. 1, 1895, p. 42.

<sup>6</sup> *American Naturalist*, XXX, 1896, p. 232.



Garman was followed by Berg<sup>7</sup> in confusing the two species, in a more elaborate synonymy than had been given by Garman. Eigenmann<sup>8</sup> in 1907, maintained the separateness of the two species and created for *G. januarius*, a new genus, *Phalloptychus*, based on the long unhooked anal of the male. For *G. caudomaculatus* was created the genus *Phalloceros*, based upon the antler-like processes at the tip of the male intromittent organ.

Philippi<sup>9</sup> in an excellent résumé of the published records, again confused the two species and considered them identical. His illustrations (Tafel I, figs. 1 and 4) show that he actually had *P. caudomaculatus*, and did not have *P. januarius*. Taf. I, fig. 3 illustrates an "Unvollständig ausgebildetes Gonopodium eines subadulten Männchens von *G. januarius*, ohne Klammerapparat (*Phalloptychus*-stadium)." This type of anal without hooks is found in developing males of most viviparous genera, and does not represent the type of structure on which *Phalloptychus* is based.

#### Genus PHALLOCEROS Eigenmann.

*Phalloceros* EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 431, fig. 7; REGAN, Proc. Zool. Soc. London, 1913, p. 999.

Type by original designation *Girardinus caudomaculatus* Hensel.

There is an outer series of compressed, oar-shaped teeth, which on each ramus flare outward toward the angle of the mouth. Their margins toward the tips are in contact and only the tips protrude from the jaw. Behind these, lies an inner series of very small, conical teeth.

The anal fin of the male is modified into a long, intromittent organ, its origin slightly forward of the anterior third of the total length. Its length is contained 3.3 times in the length of the fish. Ventrals short, hardly reaching the anal, their origin directly below that of the pectoral. Caudal rounded.

First and second anal rays in the male minute; third, fourth, and fifth anal rays united and greatly prolonged; other rays much shorter. The tip of the fin bends gracefully downward; the fourth ray ends in an obtuse point, bent downward at right angles to the rest of the fin.

<sup>7</sup> *Anales del Mus. Nac. de Buenos Aires*, V, 1897, p. 289.

<sup>8</sup> *Proc. U. S. Nat. Mus.*, XXXII, 1907, p. 425.

<sup>9</sup> "Fortpflanzungsgeschichte der viviparen Teleostier *Glaridichthys januarius* und *G. decem-maculatus* in ihrem Einfluss auf Lebensweise," etc., *Zoologische Jahrbücher*, XXVII, 1908, pp. 4 et seq.



The fourth ray bears dorsally a series of recurved hooks, which are protected by the fifth. At the tip, the organ bears on the under side two antler-like processes. These bear a prong near their tips.

*Girardinus* and *Glaridichthys* of Cuba differ from each other by the presence in the latter of an inner series of teeth. *Phalloceros* differs from *Glaridichthys* by the lack of retrorse hooks on the posterior margin of the anal and the presence of the terminal antler-like processes. Reference should be made to the excellent figure of the generic characters, given by Eigenmann, *loc. cit.*, p. 431, fig. 7. The genus up to date has remained monotypic.

22. ***Phalloceros caudomaculatus*** (Hensel). (Plate XVIII, fig. 2.)

*Girardinus caudimaculatus* HENSEL, Arch. für Naturgesch., XXXIV, 1868, p. 362; *ibid.*, XXXVI, 1870; VON IHERING, Zeitsch. f. wiss. Zoöl., XXXVIII, 1883, p. 468, pl. 26; EIGENMANN & EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 65; VON IHERING, Süßwasserf. v. Rio Grande do Sul, 1893, p. 28; COPE, Proc. Amer. Phil. Soc., XXXIII, 1894, p. 102.

*Pæcilia caudomaculatus* EIGENMANN, Ann. N. Y. Acad. Sci., VII, 1894, p. 636.

*Girardinus caudomaculatus* EIGENMANN & NORRIS, Revista Mus. Paulista, IV, 1900, p. 361; EIGENMANN, Ann. Carnegie Mus., IV, 1907, p. 143.

*Phalloceros caudomaculatus* EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 431; Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 458; REGAN, Proc. Zoöl. Soc. London, pt. IV, 1913, p. 999, Pl. C., figs. 5, 6, and text-fig. 172 C.

*Glaridodon januarius* GARMAN, Mem. Mus. Comp. Zoöl., XIX, (1), 1895, p. 42, pl. VIII, fig. 15; BERG, Anales Mus. Nac. Buenos Aires, V, 1897, p. 289.

? *Girardinus januarius* RIBEIRO, Arch. Mus. Nac. Rio de Janeiro, XIII, 1906, p. 16. *Glaridichthys januarius* PHILIPPI, Zoöl. Jahrb., XXVII, 1908, p. 4.

The following specimens were all collected by Mr. J. D. Haseman. 4671, C. M. Seven, two males, four females, one young, 21 to 35 mm.

From Entre Rios, Rio Parahyba.

4672, C. M. One female, 25 mm. Munez Freire, Rio Itapemerim.

4673, C. M. Six, two males, three females, one young, 16-28 mm. Barra da Pirahy, Rio Parahyba.

4674 C. M., six, two males, two females, two young. 14-32 mm. Santa Rita de Jacutinga, Rio Preto into Parahyba.

4675 C. M., seventy-nine, seventeen males, sixty-two females. 15-41 mm. Jacarehy, Rio Parahyba, São Paulo.

4676 C. M., thirty-one, four males, twenty-seven females. 20-41 mm. Mogy das Cruzes, Rio Tieté, into Paraná.

4677 C. M., eight, two males, five females, one young. 16-30 mm. Jundiahy, São Paulo.

- 4678 C. M., twenty-three, six males, fourteen females, three young. 19-56 mm. Raiz da Serra, Rio Mogy into Santos Bay.
- 4679 C. M., seven, five males, two young. 20-40 mm. Alto da Serra, Rio Tieté, into Paraná.
- 4680 C. M., four, one male, two females, one young. 9-48 mm. Cubatão, Rio Cubatão.
- 4681 C. M., twenty-one, three males, eighteen females. 22-35 mm. Mogy Guassu, Rio Mogy Guassu into Rio Grande, into Paraná.
- 4682 C. M., thirteen, three males, ten females, 21-45 mm. Salto de Avanhandava, Rio Tieté.
- 4683 C. M., five, all females; 19-37 mm. Bauru, Rio Tieté.
- 4684 C. M., fifteen, five males, eight females, two young. 18-40 mm. Iguapé, Rio Ribeira da Iguapé.
- 4685 C. M., fifteen, eleven females, four young. 8-43 mm. Morretes on Marumby into Rio Nhundiaquara.
- 4686 C. M., seventeen, one male, thirteen females, three young. 18-38 mm. Porto Alegre, Rio Grande do Sul.
- 4687 C. M., four females. 20-35 mm. Cachoeira, Rio Jacuhy, Rio Grande do Sul.
- 4688 C. M., nineteen, seven males, ten females, two young. 16-38 mm. Sapucay, Paraguay.
- 4689 C. M., three females. 17-28 mm. Villa Hays, Rio Confusso, into Rio Paraguay.

*Range:* Rio de Janeiro to Uruguay and Paraguay.

Head 4.1-4.2; depth at origin of anal, in females 4.2-4.5, in males 4; depth of caudal peduncle, 7.2-8.5 in length to base of caudal, 1.7-2 in head; D. 8; A. 10; P. 10; V. 5; 29-30 scales in lateral series; 8 in transverse series. Eye equal to interorbital; 2.8 in head.

Origin of the dorsal about midway in the total length, slightly posterior or opposite to anal origin. Pectorals large, extending over ventrals; caudal rounded.

General color in spirits olivaceous, scales margined with darker. Fins usually immaculate, sometimes spotted or tipped with chromatophores. The most conspicuous marking is a vertical spot of black, slightly posterior to the dorsal, on the seventeenth or eighteenth scale posterior to the pectoral origin; the twelfth or thirteenth scale forward from the caudal, the fourth scale obliquely from the dorsal. The darkened area usually extends under adjoining scales, forming a spot about half the diameter of the eye. In young specimens, a

series of very faint, narrow, vertical bars appears on the sides, in one of which the spot appears.

Some variations from this general type of coloration occur. In the series of seven specimens from Entre Rios, the caudal spot is entirely lacking, faintly vermiculated bars taking its place. The same condition prevails in a number of specimens from Raiz da Serra.

In a series of twenty-one specimens from Mogy Guassu, this variation is considerable. These specimens have a series of oblong spots extending along the sides, varying in number from seven to the usual single spot. This latter spot always appears in the proper place. Hardly two individuals are alike.

In the two hundred and sixty-two mature specimens in these collections, there are fifty-five males and two hundred and seven females. The sex ratio of this species, as here represented is thus 1 : 3.76. The largest specimen, a pregnant female from Raiz da Serra, is 55 mm. in total length. This specimen was opened and found to contain thirty-nine well-developed embryos. The alimentary tract was about three times as long as the entire fish and was filled with mud.

On account of the confusion of this species with *Phalloptychus januarius*, I have given the complete synonymy of the two species. When males are present, there should be no confusion, since the structure of the anal fins is entirely different.

#### **Phallotorynus**<sup>10</sup> Henn, gen. nov.

Allied to *Phalloceros*. Distinguished at once from all described genera of the *Pæciliidæ* by the peculiar terminal organ of the anal fin of the male, which resembles a garden trowel or scoop. Anal in

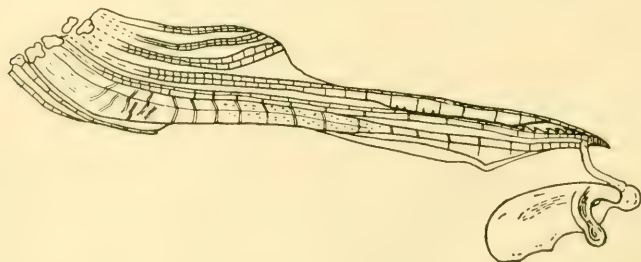


FIG. 8. *Phallotorynus fasciolatus* Henn. Side view of anal fin of male.  $\times 9.5$ . No. 3753a, Carnegie Museum. Jacarehy, São Paulo, Brazil.

<sup>10</sup>  $\phi\alpha\lambda\lambda\acute{o}s$ , intromittent organ;  $\tau\omicron\rho\acute{o}\nu\eta$ , trowel.

the male inserted at about the proximal third of the entire length; ventrals thoracic, minute, not modified. First and second anal rays of the male minute; third, fourth, fifth, and sixth, much prolonged. The third ray forms an obtuse angle near its tip, where it is produced dorsally, joining the tip of the fourth to form the pedicle of the terminal process. The fifth ray is longest, terminating in a point; posteriorly there is a series of about six retrorse hooks upon its dorsal ridge. Sixth ray compressed posteriorly, bending ventrally to join the fifth. Seventh, eighth, and ninth rays normal, successively shorter. The terminal organ has the form of a scoop and there is a compressed horn or extension on each side. This is poised at right



FIG. 9. *Phallotorynus fasciolatus* Henn. Inferior view of premaxillaries with teeth. One tooth probably missing from left ramus.  $\times 26$ . No. 3754, Carnegie Museum.

angles to the pedicle. There is a single series of teeth, shaped like spoon-oars, in each jaw. The tips of the teeth are slightly expanded and bent backward. The intestine is about twice the length of the entire fish.

This remarkable little fish has attained a high degree of complexity in the apparatus for the transfer of spermatozoa to the female. The sperm-duct, as in related genera, opens backward at the very base of the anal. The sexual products probably appear in the form of the sperm-aggregations, the occurrence of which in *Phalloceros caudomaculatus* has already been mentioned. The hinder portion of the anal fin seems to be somewhat flexible and may fold over the inflexible prolonged rays, to form a groove or trough which would have the open side along the ventral edge. The close apposition of the two edges of the fin would form a channel for the conduction of the sexual products. The ventral fins are too small to be of service, but the pectoral fins, although small, by being placed over the mouth of the sperm duct, may cause the entrance of the sexual products into this

groove. The scoop or terminal process of the anal fin, if movement of the handle or pedicle is possible, could be raised to receive the spermatozoa as they issue from the end of the trough. By the usual movements during copulation they could then be placed on the genital papilla of the female. Since the living fish has not been observed, these remarks are naturally conjectural.

Views of the terminal process of the intromittent organ from both above and below are shown in Figs. 10 and 11. It was suggested that

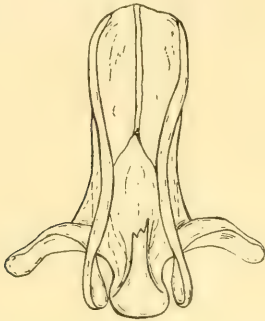


FIG. 10.



FIG. 11.

FIG. 10. *Phallotorynus fasciolatus* Henn. View from above of terminal portion of anal, detached from the pedicle.  $\times 18$ . No. 3753a, Carnegie Museum. Jacarehy, São Paulo, Brazil.

FIG. 11. View from below of same object shown in Fig. 10.  $\times 18$ .

this might be an elaborate device for enclosing the spermatozoa, somewhat analogous to the egg case of the skate. Accordingly one of them was decalcified, imbedded, and cut into very thin sections and stained with iron-alum hæmatoxylin. This procedure showed conclusively that the terminal process is not a sperm case, but is an



FIG. 12.



FIG. 13.

FIG. 12. *Phallotorynus fasciolatus* Henn. Section through center of terminal portion of anal.  $\times 30$ .

FIG. 13. *Do.* Section through posterior portion of terminal part or scoop of the anal.  $\times 30$ .



actual part of the fin. If used, as suggested above, for the transference of spermatozoa, it was empty at the time of capture. Sections near the center and through the posterior portion respectively, are shown in figures 12 and 13. Other than in the character of the anal fin, or intromittent organ, this fish does not greatly differ from a number of related species.

23. *Phallotorynus fasciolatus* Henn, sp. nov. (Plate XXI, figs. 1 and 2.)

3752, C. M., **type**, male, 20 mm.; 3753 *a-b*, C. M., **paratypes**, two males, 19.5–22 mm., eight females, 20.5–28.5 mm. One mile north of Jacarehy, São Paulo, Brazil, from the basin of the Rio Parahyba, July 14, 1908. Haseman.

Head 4.4–4.6; depth at origin of anal 4–4.5; depth of caudal peduncle 5.5–6; D. 8; A. 11 (male 9); P. 10; scales 28–30 + 1 from upper angle of gill-opening to caudal; fourteen scales between large occipital scale and origin of the dorsal; nine scales in a transverse series. Eye 1.5 in the interorbital width, 2.5 in the head; interorbital 1.6 in the head. Snout and head broad, depressed; profile slightly arched; mouth vertical, premaxillaries protractile. Second dorsal ray in the female nearly over the last ray of the anal. Origin of the dorsal slightly in advance of the middle of the total length. The anal of the male, exclusive of the clasper, equals about one-fourth of the total length. Pectorals large, reaching to above middle of ventrals; the latter minute, barely reaching the vent. Caudal rounded, hyaline. Viviparous. A female which was examined contained nine large yolk-laden ova. Intestine about twice the total length; fins are usually without pigment; the dorsal and anal fins of a few specimens are pigmented. Sides with six or seven narrow, vertical bands, or streaks of dark brownish pigment.

Genus *CNESTERODON* Garman.

*Cnesterodon* GARMAN, Mem. Mus. Comp. Zoöl., XIX, (1), 1895, p. 43; REGAN, Proc. Zoöl. Soc. London, pt. IV, 1913, p. 1000.

*Gulapinnus* LANGER, Morph. Jahrb., XLVII, 1913, p. 207.

Type of genus, by original designation *Pæcilia decem-maculatus* Jenyns.

The dentition consists of an outer series of compressed, slightly recurved, spatulate incisors, with a single series of small conical teeth just behind them.



Anal of the male a long intromittent organ, inserted below the pectorals. Its length is about 1.7 that of the head. First and second anal rays minute; third, fourth, fifth, and sixth, prolonged. Fourth ray terminating in a point, immediately ventral to this, a *single* long sickle, or hook. Fifth ray bearing near its upturned tip a series of retrorse hooks. Sixth ray bending ventrally; near its tip a sharp recurved spine. Other rays successively shorter.

Garman based this genus on immature males, the anals of which were plain sword-like organs without hooks. A good figure of the male anal of *Cnesterodon* is given by Philippi, *Zoöl. Jahrb.*, XVII, 1908, p. 19, fig. B.

*Phalloceros* differs from this genus by the possession of two much smaller hooks or antler-like processes.

#### 24. *Cnesterodon decem-maculatus* (Jenyns).

*Pœcilia decem-maculatus* JENYNS, Beagle Zoöl., Fishes, 1842, p. 115 (Maldonado). *Girardinus decem-maculatus* BOULENGER, Boll. Mus. Torino., X, No. 196, 1895, p. 3 (Buenos Aires); LAHILLE, Revista Mus. de la Plata, VI, 1895, p. 275 (La Plata); BOULENGER, Boll. Mus. Torino, XII, No. 279, 1897, p. 4 (Caiza, Bolivian Chaco.) *Cnesterodon decem-maculatus* GARMAN, Mem. Mus. Comp. Zoöl., XIX, (1), 1895, p. 44, pl. V, fig. 13, teeth; pl. VIII, fig. 16, male (Uruguay River, Maldonado); BERG, Ann. Mus. Nac. Buenos Aires, V, 1897, p. 290 (Argentina, Uruguay, Brazil); EVERMANN & KENDALL, Proc. U. S. Nat. Mus., XXXI, 1906, p. 90 (Argentina); EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 431 (Rio Grande do Sul); EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 458; REGAN, Proc. Zoöl. Soc. London, 1913, p. 1000, fig. 172 B. *Gladiichthys decem-maculatus* PHILIPPI, Zoöl. Jahrb., XVII, 1908, pp. 10 *et seq.* *Cnesterodon carnegiei* HASEMAN, Ann. Carnegie Mus., VII, 1911, p. 385, pl. LXXXIII (Serrinha Paraná, Rio Iguassú).

4661, C. M. Three; two males, one female. 18–22 mm. Cacequy, Rio Ibicuhy, Rio Grande do Sul.

4662, C. M. Two; male and female. 19–20 mm. Monté, Argentina.

The following description is based upon paratypes of *Cnesterodon carnegiei* Haseman, which seems to be identical with *C. decem-maculatus*.

Head 4.2–4.8; equal to depth at origin of dorsal; depth of caudal peduncle 7.5–8.6 in length; caudal peduncle about 1.5 in head. Snout short and blunt; mouth oblique; snout 1.2 in eye. Eye medium; 3–3.5 in head.

A male has the head 5; depth at origin of dorsal 5; caudal peduncle 7.1 in length and 1.4 in head.

D. 8–9; A. 9–10; P. 10; V. 4–5; scales 28–31 in lateral line series; 8–9 in transverse series.

Broadly depressed anteriorly, compressed posteriorly. Profile slightly arched. Distance from tip of snout to origin of dorsal in females about equal to the distance from last ray of anal to tip of caudal. Origin of dorsal slightly posterior to vertical from the origin of the anal. Ventrals small, barely reaching the vent, caudal rounded.

A series of oblong vertical spots or bars on the sides of the fish. These vary in number from six to twelve, their number is usually about nine. Males have a prominent V-shaped mark immediately ventral to the dorsal, which is produced into a line of pigment on the keel of the caudal peduncle.

### Genus PÆCILIA Schneider.

*Pæcilia* BLOCH, Syst. Ichth.; 1801, p. 451; GARMAN, Mem. Mus. Comp. Zool., Vol. XIX, 1895, p. 52; REGAN, Proc. Zool. Soc. London, 1913, p. 1005.

Type, *Pæcilia vivipara* Bloch and Schneider.

As now restricted by Regan, this genus comprises a few species limited to the northeastern portion of South America.

The anal fin of the male is shorter than the head and very similar in structure to that of *Lebistes* and *Mollienisia*, from both of which it differs in the absence of the modified terminal segment of the third prolonged ray.

Photographs of all of the species, except *P. branneri*, which has never been figured, are given by Eigenmann in Memoirs Carnegie Museum, Vol. V, pl. LXIV-LXVI.

### 25. *Pæcilia vivipara* Bloch & Schneider.

*Pæcilia vivipara* BLOCH & SCHNEIDER, Syst., Ichth., 1801, p. 452, pl. 86, fig. 2; GARMAN, Mem. Mus. Comp. Zool., XIX, (1), 1895, p. 53; EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 460; EIGENMANN, Mem. Carnegie Museum, V, 1912, p. 456, pl. LXIV, fig. 3, male, fig. 4, female (Georgetown, Brit. Guiana); REGAN, Proc. Zool. Soc. London, 1913, p. 1005, fig. 173 C.

? *Pæcilia amazonica* Garman, Mem. Mus. Comp. Zool., XIX, (1), 1895, p. 64, pl. IV, fig. 9, teeth (Santa Cruz, Para).

The following specimens were all collected by Haseman.

4646, C. M., seventeen, three males, twelve females, two young. 13-48 mm. Alagoinhas, Rio Catu, Bahia.

4647, C. M., eleven, 9-18 mm. Maceio, Rio San Francisco.

4648, C. M., fifteen, two males, eight females, five young. 14-37 mm. Penedo, Alegoas, Brazil.

4649, C. M., ten, 15-41 mm. Barra de Penedo, Rio San Francisco.

- 4650, C. M., twenty-eight, three males, twenty-four females, one young.  
17-70 mm. Cachoeira, Rio Paraguassú.
- 4651, C. M., five, one male, three females, one young. 11-42 mm.  
Campos, Rio Parahyba.
- 4652, C. M., forty-eight, three males, forty-five females. 25-51 mm.  
Munez Freire, Rio Itapemerin.
- 4653, C. M., five, one male, four females. 29-43 mm. São João da  
Barra, Parahyba.
- 4654, C. M., eleven. 10-21 mm. Alto da Serra, São Paulo.
- 4655, C. M., two. 46-61 mm. Iguapé, Rio Ribeira da Iguapé.  
From R. Krone.
- 4656, C. M., twelve, three males, nine females. 38-50 mm. Iguapé.  
Rio Ribeira da Iguapé.
- 4657, C. M., three. 12-24 mm. Bom Jesus dos Meiras, Rio San  
Francisco.
- 4658, C. M., one. 30 mm. Raiz da Serra, São Paulo.

Some variation occurs in different localities, particularly in the number of dorsal and anal fin-rays. Specimens from localities in the southern part of its range show the shortened dorsal said by Garman to be characteristic of *P. amazonica*. However, such complete gradation exists in a single locality, that separation into two species is not possible. *P. amazonica*, said by Garman to be closely related to *P. vivipara*, is probably synonymous with it. I have not been able to examine typical specimens.

## 26. *Pæcilia paræ* Eigenmann.

*Pæcilia vivipara paræ* EIGENMANN, Ann. N. Y. Acad. Sci., Vol. VII, 1894, p. 629 (Pará).

*Pæcilia paræ* REGAN, Proc. Zool. Soc. London, 1913, p. 1006, text-fig. 173b (anal).

*Acanthophaelus bifurcus* EIGENMANN, Mem. Carnegie Mus., Vol. V, 1912, p. 459, pl. LXV, figs. 4, 5, and 6.

I am not positive that *P. bifurcus* is a synonym of *P. paræ*, although it is quite certain that *bifurcus* is a *Pæcilia*. Typical specimens of *P. paræ* are too much shrunken to permit a final decision.

## 27. *Pæcilia melanzona* (Eigenmann).

*Acanthophaelus melanzonus* EIGENMANN, Ann. Carnegie Mus., Vol. VI, 1909, p. 51; Mem. Carnegie Mus., Vol. V, 1912, p. 457, pl. LXIV, fig. 5.

1086, C. M. Type, male, 27 mm. Georgetown, British Guiana.

Eigenmann based this species on a male, as the type, with which were associated seven females, which seem to belong to a distinct species, subsequently described by Regan as *P. picta*. The apparent

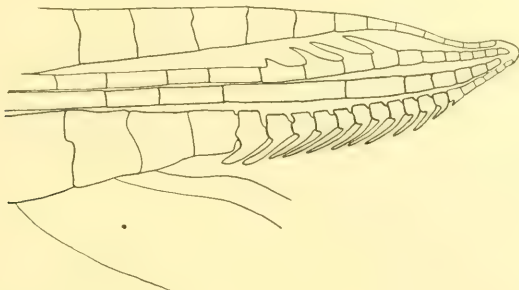


FIG. 14. *Pæcilia melanazona* (Eigenmann). Distal end of anal of male.  $\times \frac{40}{1}$ .  
No. 1,086, Carnegie Museum. Georgetown, Brit. Guiana.

differences between the single male and the females were supposed to be those of sexual dimorphism. Regan's material contained males agreeing in coloration with these females, to which they unquestionably belong, showing their specific distinctness from *P. melanazona*. Regan's supposition that the type of *A. melanzonus* is a male of *Lebistes reticulatus* is erroneous, as will be seen by reference to the accompanying figure of the anal fin, which is that of a *Pæcilia*.

The type, which is unique, has a broad lateral band of clear white or silvery, bordered by narrow lines of chocolate. Females of this species are unknown.

## 28. *Pæcilia picta* Regan.

*Acanthophaelus melanzonus* EIGENMANN (*in part*, females), Ann. Carnegie Museum, Vol. VI, 1909, p. 51; Mem. Carnegie Museum, Vol. V, 1912, p. 457, pl. LXIV, fig. 6.

*Pæcilia picta* REGAN, Proc. Zool. Soc. London, 1913, p. 1007, pl. C, fig. 1, 2, and text-fig. 173 A (Demerara).

As stated in the remarks under *Pæcilia melanazona*, that species was a composite based upon a male (type) and several females supposed to belong to it, but shown by males in Regan's material to be distinct and described by him as the present species. Both are distinct and valid species of the genus *Pæcilia*. Males and females of this species are more or less similar in coloration.

29. *Pœcilia branneri* Eigenmann.

*Pœcilia branneri* EIGENMANN, Ann. N. Y. Acad. Sci., VII, 1894, p. 629. (Santarem, Pará); EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 460; REGAN, Proc. Zoöl. Soc. London, 1913, p. 1007.

*Pœcilia heteristia* REGAN, Ann. Mag. Nat. Hist., (8) Vol. III, 1909, p. 235 (Para); EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 460.

No specimens were secured by Haseman.

I have examined the typical specimens; one male, 22 mm., five females, 16–25 mm., Nos. 5082 and 5084, I. U. M. Four of the females are in a very poor state of preservation.

This species differs from *Lebistes reticulatus* Peters, with which it was considered identical by Garman (The Cyprinodonts, p. 62) in the male anal structure, fin formulæ, and coloration.

*P. branneri* has D. 7; A. 8; V. 6; P. 13.

*L. reticulatus* has D. 6–7; A. 10; V. 6; P. 12.

In *P. branneri* both sexes have a single vertical oblong spot at the base of the caudal; in *L. reticulatus* only the males possess spots, these number two or three, vary in location, and are usually circular.

In the single male of *P. branneri*, the last two rays of the dorsal are greatly prolonged and extend over the middle of the caudal. In males of *L. reticulatus*, the dorsal is normal.

Head 3.8; equal to depth at origin of dorsal; caudal peduncle 5.4 in length. Eye about 3 in head.

Dorsal origin posterior to that of anal, about in the middle of total length. Ventrals lanceolate (in females), reaching almost to origin of anal. Caudal rounded.

## Genus LEBISTES Filippi.

*Lebistes* FILIPPI, Arch. Zoöl. Anat. Fisiol., Vol. I, 1861, p. 69.

*Acanthophaelus* EIGENMANN, Proc. U. S. Nat. Mus., Vol. XXXII, 1907, p. 426, fig. 1.

30. *Lebistes reticulatus* (Peters).

*Pœcilia reticulata* PETERS, Monatsb. Akad. Berlin, 1859, p. 412; Garman, Mem. Mus. Comp. Zoöl., Vol. XIX, 1895, p. 62.

*Lebistes reticulatus* REGAN, Proc. Zoöl. Soc. London, 1913, p. 1008.

Through the kindness of the late Dr. S. E. Meek, of the Field Museum of Natural History of Chicago, I have been enabled to examine the specimens recorded by him as *Girardinus vandepolli* (Van Lidth de Jeude) from Curaçao, an island of the Dutch West Indies (Pubs. Field Col. Mus., 1909, Zoöl. Series, Vol. VII, No. 7, p. 209).



These agree in all respects with typical specimens of *Lebistes reticulatus* from Barbadoes.

Genus MOLLIENTISIA Le Sueur.

*Mollienisia* LE SUEUR, Journ. Acad. Nat. Sc. Phila. II, 1821, p. 3; REGAN, Proc. Zool. Soc. London, 1913, p. 1010.

This genus is very closely related to *Pæcilia*, from which it differs in having an obtuse downward point at the end of the first prolonged ray of the anal and another segment, directed dorsally, as in *Lebistes* at the tip of the fourth prolonged ray. The chief difference between *Pæcilia* and *Mollienisia* is the longer dorsal in the latter. *Pæcilia*, *Mollienisia*, and *Lebistes* might be considered members of the single comprehensive genus, *Pæcilia*.

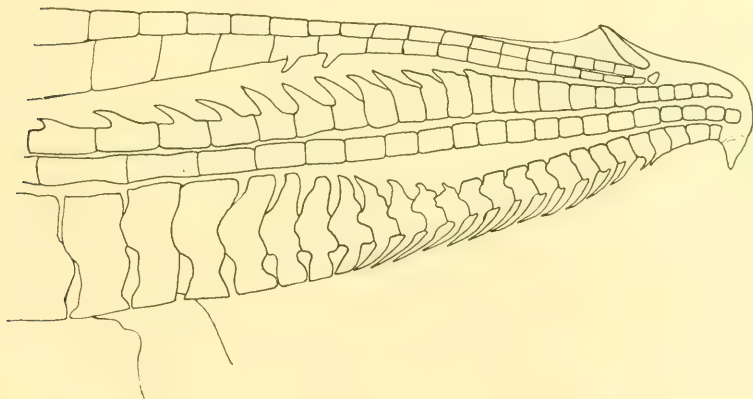


FIG. 15. *Mollienisia latipinna* Le Sueur. Distal end of anal of male.  $\times \frac{40}{1}$ .  
No. 9201, I. U. M. Baldwin Lodge, Mississippi.

The anal of the male is shorter than the head and slightly more than one-fifth of the total length. The ventrals are set close to the anal; the second ray, or the ray next the outer one, is prolonged into a club-shaped filament, which is almost as long as the anal and extends to or beyond the middle of that organ. The ventral part of the tip of the fin has a prepuce or dermal hood as in *Pæcilia* and *Lebistes*.

Type of the genus *M. latipinna* Le Sueur.



31. *Mollienisia sphenops* (Cuvier and Valenciennes).

*Pæcilia sphenops* CUV. & VAL., Hist. Nat. Poiss., XVIII, 1846, p. 130, pl. 526.

*Mollienisia sphenops* REGAN, Proc. Zool. Soc. London, 1913, p. 1013, text-fig. 173F.

6699 *a-c*, C. M.; 13617, I. U. M., six. 47-57 mm. Brackish water at Cartagena, Colombia. C. H. Eigenmann.

In addition to these examples, the University of Michigan possesses a few specimens from fresh waters at Santa Marta and the Rio Manzanares near Santa Marta and Mamatoco, in the Santa Marta Mountains of Colombia.

32. *Mollienisia caucana* (Steindachner).

*Girardinus caucanus* STEINDACHNER, Denkschr. K. K. Akad. Wiss. Wien. XLII,

1880, p. 87, pl. VI, figs. 4, 5 (Caceres, Colombia); STEINDACHNER, *ibid.*, LXXII,

1902, p. 146 (Baranquilla).

5826 *a*, C. M. A single female 34 mm., Cienaga at Calamar, Colombia. Eigenmann.

A male, 22 mm., from Fundación is in the collection of the University of Michigan. The tip of the anal fin of this specimen is shown in Fig. 16.

D. 7-8; A. 9; P. 10; V. 6; I. 1. 26-27. •

This species is very closely related to *M. sphenops* and seems to differ chiefly in coloration. It has the basal half of the dorsal broadly banded with intense black, thence a clear portion, which is again

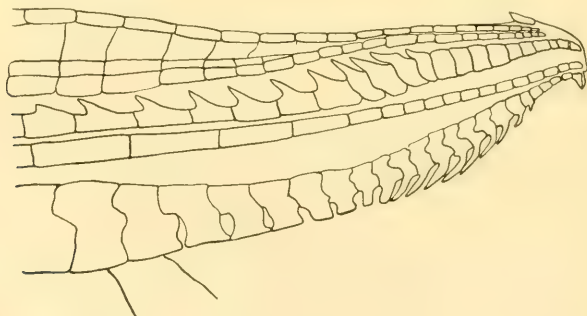


FIG. 16. *Mollienisia caucana* (Steindachner). Distal end of anal of male.  $\times \frac{40}{1}$ . Fundación, Colombia.

margined with black. The base of the last rays of the anal in the female is also covered by a black spot. There are faint indications of a number of transverse lines on the sides.

The structure of the anal of the male seems also to differ in the lesser number of segments with ventral hooks in the first prolonged ray and in the absence of spinous or dorsal processes on these segments. The first and second prolonged rays are more clearly separated in *M. caucana*. These specific differences in anal structure exist between specimens of the same size.

Genus LIMIA Poey.

*Limia*, POEY, Memorias Cuba, Vol. I, 1855, p. 383; REGAN, Proc. Zool. Soc. London, 1913, p. 1014.

Type, *Limia cubensis* Poey = *Pæcilia vittata* Guichenot.

This genus, while closely related to *Pæcilia*, *Mollienisia*, and *Lebistes*, is distinguished from these genera by the absence of forward-projecting spines on the ventral portion of the segments in the first prolonged ray of the anal. This ray is club-shaped and without

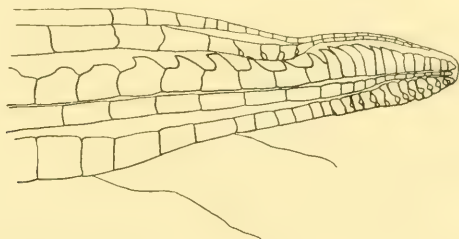


FIG. 17. *Limia hollandi* Henn. Distal end of anal of male.  $\times \frac{40}{1}$ .  
No. 4640, Carnegie Museum. Boqueirão, Brazil.

serrations. The third prolonged ray bears the usual dorsal serrations. In most of the species, but not in the present, there is an antrorse spine on the ventral surface near the extremity of the first prolonged ray.

The anal of the male is shorter than the head; the ventrals are equal to the head in length and are lancolate in shape. A dermal hood or prepuce occurs near the extremity of the fin.

This genus includes eight species, seven of which are from Cuba, Haiti, and Jamaica, and one from the mainland at La Guayra, Venezuela. The present new species is from the basin of the Rio San Francisco and neighboring streams of Brazil.

33. *Limia hollandi* Henn, sp. nov. (Plate XIX, fig. 3.)

4643, C. M., **type**, female, 34 mm.; 4643 b-d, C. M., **paratypes**, three females, 13-34 mm. From Penedo, Rio San Francisco. Haseman.

Other specimens collected by Haseman are:

4635, C. M., seven females, 26-29 mm. Lagoa, Barreiras, Rio San Francisco.

4636, C. M., five females, 15-32 mm. Baixa Grande, Rio Paqui.

4637, C. M., one female, 21 mm. Joazeiro, Rio San Francisco.

4638, C. M., two females, 27-28 mm. Cachoeira de Pirapora, Rio San Francisco.

4639, C. M., eleven, three males, eight females, 19-24 mm. Lagoa de Porto, Rio San Francisco.

4640, C. M., twelve, two males, eight females, two young. 16-26 mm. Boqueirão, Rio Grande, Rio San Francisco.

4641, C. M., twelve females, 18-27 mm. Santa Rita de Rio Preto.

4642, C. M., five females, 18-33 mm. Rio Itapicurú near Timbo, Bahia.

4644, C. M., one female, 28 mm. Alto da Serra, São Paulo.

4645, C. M., three females, 41-43 mm. Rio Pilão near Santos, São Paulo.

Head 3.8-4.2; depth at origin of dorsal about equal to length of head; caudal peduncle 6.5-6.8 in length, 1.6-1.7 in head. Eye equal to narrowest width of interorbital and 2.6-3 in head. Profile highly arched or humped. Head depressed and broad.

D. 7; A. 8-9; P. 10; V. 6; scales 27-29 in lateral line; 7 in transverse series.

Origin of dorsal over last rays of anal. In females the distance from the tip of the snout to the origin of the dorsal about equals that from the origin of the anal to the middle, or end, of the caudal. Ventrals lanceolate, middle rays longest, barely reaching the vent.

In males the ventrals arise on a prominence directly under the pectorals. They are greatly produced, bear processes near their tips and are about as long as the head. The anal is about 1.5 as long as the head.

The fins are without color. A single male from Barreiras has the lower portion of the dorsal heavily pigmented and an oblong spot at the base of the caudal. The posterior dorsal rays are not produced.

A female from Rio Pilão, 42 mm. in total length, contained twenty-four embryos, curled, but seemingly ready for expulsion.

Color in spirits, golden yellow. Margins of scales outlined with darker. A conspicuous dark zig-zag line of chocolate pigment is formed by the heavily pigmented upper margins of the scales in the sixth lateral series, counting ventrally and transversely from the dorsal. Then ext series of scales below forms a clear streak without pigment. The keel of the caudal peduncle is also slightly pigmented.

Named for Dr. W. J. Holland, whose interest and support has made possible the extensive collections of South American fishes in the Museum of which he is Director.

#### Genus FITZROYIA Günther.

*Fitzroyia* GÜNTHER, Cat. Fishes Brit. Mus., VI, 1866, pp. 299, 307 (*multidentata*).

*Jenynsia* GÜNTHER, *ibid.*, VI, 1866, pp. 300, 331 (*lineata*).

Type of genus by monotypy *Lebias multidentata* Jenyns = *Lebias lineata* Jenyns.

The dentition consists of an outer series of compressed, slightly recurved, tricuspid incisors, immediately behind these a band of much smaller tricuspid teeth. Intestine about equal to, or less than, the length of the fish.

Anal fin of the male modified to form a tube. Anal rays separate, but enclosed in a loose sheath, forming the tube. The tip of this organ, as pointed out by Garman, turns either to the right or left, the males are thus rights and lefts. The genital orifice of the female is symmetrical. This fact seems to indicate that the male dextrality and sinistrality, at least in this genus, has no especial significance.

The male organ of this genus is much simpler than in *Anableps*. In *Anableps* the anal rays are indeterminable, are heavily ensheathed in fleshy pads and are scaled. The anal tubular structure may thus have arisen independently in the two genera.

Several young males of *F. maculata* show the development of the tube. An epidermal flap appears, surrounding the foremost anal rays, and eventually enclosing all of them. The anal tube of adult males is about equal to the length of the head.

Body slightly depressed; snout short and blunt; cleft horizontal; lower jaw not extending beyond upper.

#### KEY TO THE SPECIES OF FITZROYIA.

- a. Scales less than eighteen between occiput and dorsal.
- b. Origin of dorsal slightly in advance of anal.
- c. Lateral line 29-30, a series of regular, longitudinal lines on the flank.  
32. *lineata* (Jenyns).

- cc. Lateral line 32-33, no lines or dots, large irregular blotches, ventral half of body darker. . . . . 33. *eigenmanni* Haseman.  
 bb. Origin of dorsal about opposite anal. A series of longitudinal rows of oblong spots. . . . . 34. *maculata* (Regan).  
 aa. Scales more than 18 between occiput and dorsal. Lateral line 32-35. . . . . 35. *pygogramma* (Boulenger).

### 34. *Fitzroyia lineata* (Jenyns).

- Lebias lineata* JENYNS, Beagle Zool., Fishes, 1842, p. 116, pl. 22, fig. 2.  
*Lebias multidentata* JENYNS, *ibid.*, 1842, p. 117, pl. 22, fig. 3.  
*Fitzroyia multidentata* GÜNTHER, Cat. Fishes Brit. Mus., VI, 1866, p. 307.  
*Jenynsia lineata* GÜNTHER, *ibid.*, 1866, p. 331; GARMAN, The Cyprinodonts, Mem. Mus. Comp. Zool., XIX, 1895, p. 69, pl. VIII, fig. 2-3; VON IHERING, Süßwasserf. v. Rio Grande do Sul, 1893, p. 28; LAHILLE, Revista Mus. de la Plata, VI, 1895, p. 275 (Arroyo del Gato); BOULENGER, Boll. Mus. Torino., X, No. 279, 1897, p. 4; REGAN, Ann. Mag. Nat. Hist., (8), XI, 1913, p. 232.  
*Jenynsia multidentata* BOULENGER, Boll. Mus. Torino, X, 1897, p. 4 (Lesser, Tala.).  
*Fitzroyia lineata* BERG, Ann. Mus. Nac. Buenos Aires, V, 1897, p. 291.  
*Fitzroyia lineata* EIGENMANN, Proc. U. S. Nat. Mus., XXXII, 1907, p. 430; Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 457.

4670, C. M., seven, one male, six females, 44-66 mm. Rio Guahyba at Porto Alegre, Rio Grande do Sul.

Range: La Plata to Rio Grande do Sul.

Head 4-4.3; depth at origin of dorsal 4-4.5, depth of caudal peduncle 7 in length to base of caudal and 1.8 in head. Eye 3 in head, equal to interorbital. Snout 1.3 in eye.

D. 8-9; A. 8; P. 14; V. 6; scales 14 between occipital and dorsal; 29-30 in lateral series; 8 in transverse series.

Origin of dorsal slightly in advance of middle of the total length; anterior to origin of anal in both sexes.

General form elongate. Pectorals large and round, caudal subtruncate. All fins usually without color.

A series of from four to six continuous horizontal lines, formed by contiguous marks on overlapping scales.

The largest specimen, a female in the I. U. M., is 69 mm. long. Of the males, which range from 25-45 mm. in length seven have the anal tube of the male turned to the right and fifteen to the left.

### 35. *Fitzroyia eigenmanni* Haseman.

- Fitzroya eigenmanni* HASEMAN, Ann. Carnegie Museum, VII, 1911, p. 385, pl. LXXXII.  
*Jenynsia eigenmanni* REGAN, Ann. Mag. Nat. Hist., (8), XI, 1913, p. 233.



2866, C. M., one, the **type**, 43 mm. 2867, C. M., thirteen, **paratypes**, 17-45 mm. Rio Iguassú system, near Serrinha Paraná, Brazil. Haseman.

Head 4-4.5; depth at origin of dorsal about equal to head; depth of caudal peduncle 7.6-7.8 in length to base of caudal and 2 in head. Eye 3.3 in head. Interorbital 1.5 in eye.

D. 8-9; A. 7-9; P. 14; V. 6; scales 16-17 between occipital and dorsal; 32-33 in lateral line; 8-9 in transverse series. The posterior 18-21 scales in the lateral series have a conspicuous central pit, or pore, the only approach to the usual lateral line pores, I have seen in any Pæciliid.

The dentition is composed of an outer series of compressed tricusps, an inner series partly of smaller tricusps and partly of spike-like incisors.

This species differs from the other members of the genus in being more elongate and more compressed. It differs also in coloration.

A broad, horizontal, purplish lateral band formed by continuous blotches. In young specimens this is a narrow broken line. Ventral half of body darker. Belly prominent, yellowish in color. Fins without color, caudal truncate.

### 36. *Fitzroyia maculata* (Regan).

*Jenynsia maculata* REGAN, Ann. Mag. Nat. Hist., (7), XVIII, 1906, p. 154 (Cachi, Salta, Argentina); *ibid.*, (8), XI, 1913, p. 233.

4667, C. M. Eleven, five males, 20-31 mm., six females, 20-52 mm.

Arroyo Miguelete, Montevideo. Haseman.

4668, C. M. Twenty, 13-20 mm. Monté, Argentina. Haseman.

4669, C. M. Fifteen, three males, nine females, three young. 11-55 mm. Near Colorado, Rio Colorado, Argentina. Haseman.

Range: Uruguay and Argentina.

Head 3.4-4; depth at origin of dorsal 4-4.5; depth of caudal peduncle 6.5-7 in length to base of caudal and 1.8-2 in head. Eye prominent, 3.4-4 in head; about equal to interorbital. Interocular width about 2.4 in head.

D. 8-9; A. 9-10; P. 14; V. 6; scales 12 between occipital and dorsal; 28-30 in lateral line; 8 in transverse series.

Origin of dorsal about opposite that of anal, sometimes slightly anterior. In males the anal is sometimes slightly in advance of the dorsal. Fins without color; pectoral large and round, caudal subtruncate or slightly rounded.



Closely related to *F. lineata*, from which it differs in having the continuous lines broken up into a series of large oblong spots.

A female (48 mm.) taken at Colorado on March 6, 1909, contained forty-eight embryos, averaging in length about 9 mm. They are straightened out and are evidently almost ready for expulsion. A large number of chromatophores are present and the lateral line is well-marked by a conspicuous row of these.

### 37. *Fitzroyia pygogramma* (Boulenger).

*Jenynsia pygogramma* BOULENGER, Ann. Mag. Nat. Hist., (7), IX, 1902, p. 336 (Cordova, Río Cruz del Eje, Argentina); REGAN, *ibid.* (8), vol. XI, 1913, p. 233. *Fitzroya pyrogramma* EIGENMANN, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 457.

No specimens were secured by Mr. Haseman. "D. 8-9; A. 9-10; L. lat. 32-35." This species appears to differ from *F. lineata* in the smaller scales "18 to 25 transverse series between the occiput and the dorsal fin" and in coloration. "Golden yellow above, speckled and spotted with black, white beneath . . . distinct black lateral streak . . . female with a large V-shaped, purplish-black marking, edged with orange, on the belly, the point on the vent."

I have examined one of the paratypes, received from Rosenberg. It most resembles *F. eigenmanni* in coloration, but differs in the numerous series of small predorsal scales.

### Genus ANABLEPS Artedi.

*Anableps* ARTEDI, Gen. Pisc., 1738, p. 25.

### 38. *Anableps anableps* Linnæus.

*Anableps anableps* LINNÆUS, Syst. Nat., Ed. 9, 1756, p. 55; GARMAN, Mem. Mus. Comp. Zoöl., Vol. XIX, 1895, p. 77.

4618, C. M., one, 178 mm., Río Caeté, Pará. Haseman.

4619, C. M., one, 98 mm., Pará. Haseman.

### 39. *Anableps microlepis* Müller and Troschel.

*Anableps microlepis* MÜLLER & TROSCHER, Monatsb. Akad. Berlin, 1844, p. 36; GARMAN, Mem. Mus. Comp. Zoöl., Vol. XIX, 1895, p. 78.

4620, C. M., two, 125-143 mm. Río Caeté, Pará. Haseman.

4621, C. M., two, 94-108 mm. Belem, Pará. Haseman.

4622, C. M., two, 52-190 mm. Pará. Haseman.

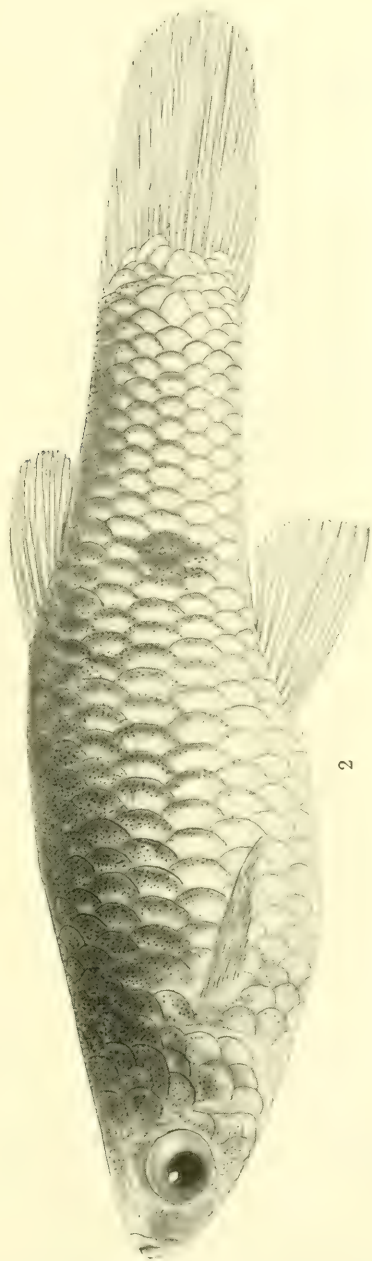
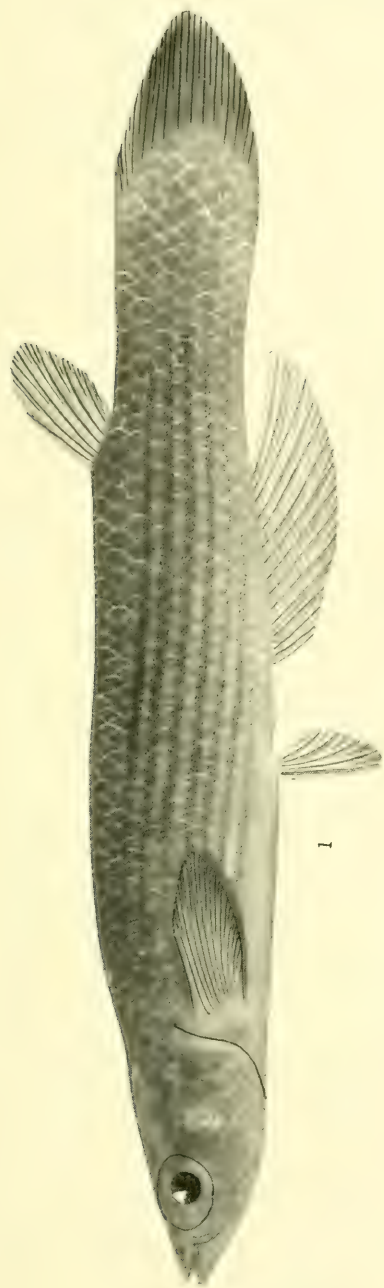


FIG. 1. *Rimulus compressus* Henn. Type. No. 5819, C. M. 55 mm. Manáos.  
 FIG. 2. *Phalloceros caudomaculatus* (Hensel). No. 4684, C. M. 39 mm. Iguape.



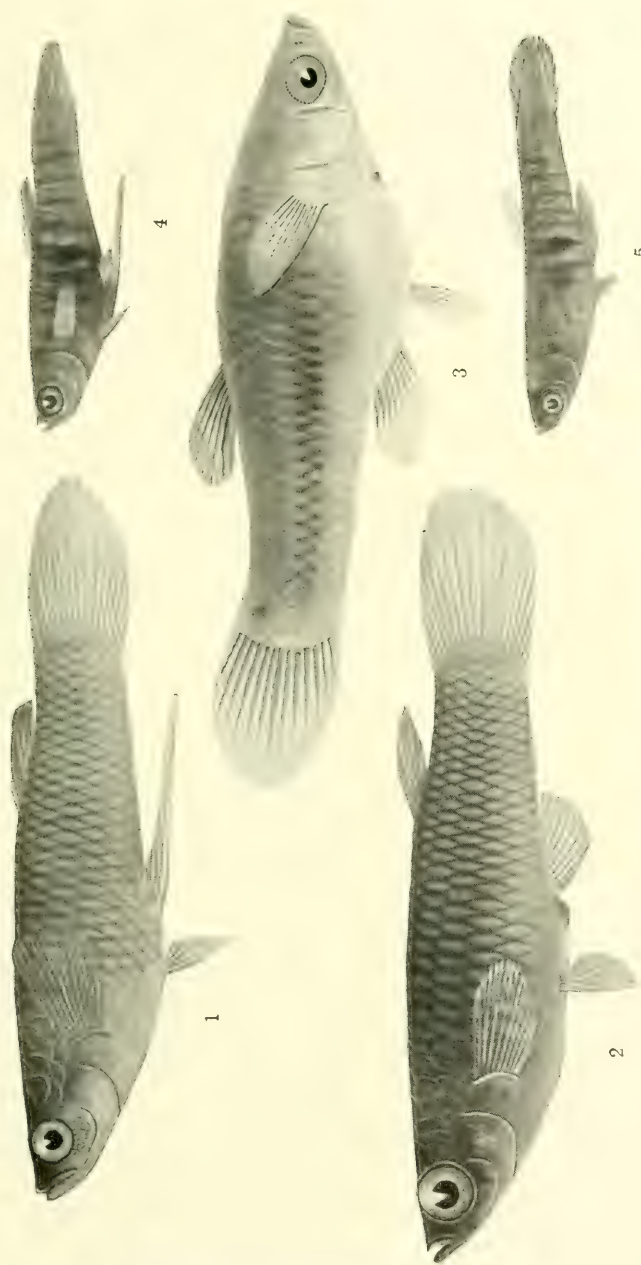


FIG. 1. *Diphyacanthia chocoensis* Henn. ♂. Type. No. 13618, I. U. M. 31 mm. Rio Calima of San Juan.  
 FIG. 2. *Diphyacanthia chocoensis* Henn. ♀. Paratype. No. 13619, I. U. M. 33 mm. Rio Calima of San Juan.  
 FIG. 3. *Limia hollandi* Henn. Type. No. 4643, C. M. 34 mm. Petledo.  
 FIG. 4. *Neoheterandria elegans* Henn. ♂. Type. No. 5823, C. M. 16.5 mm. Rio Truando.  
 FIG. 5. *Neoheterandria elegans* Henn. ♀. Paratype. No. 5824, C. M. 16 mm. Rio Truando.



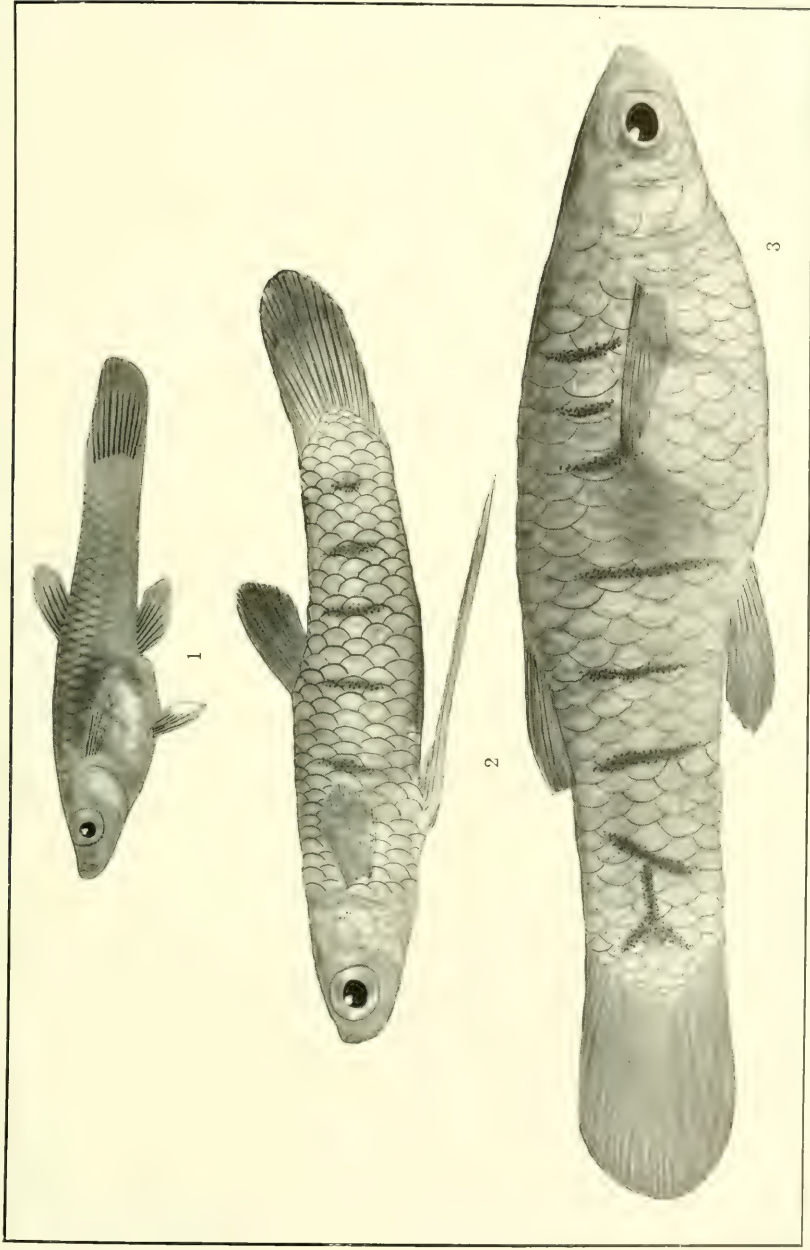


FIG. 1. *Heterandria hasemani* Henn. Type, No. 4663, C. M. 20 mm. Puerto Suarez.

FIG. 2. *Phallopterychus eigenmanni* Henn. ♂. Paratype, No. 4666, C. M. 20 mm. Alagoinhas.

FIG. 3. *Phallopterychus eigenmanni* Henn. ♀. Type, No. 4665, C. M. 20 mm. Alagoinhas.





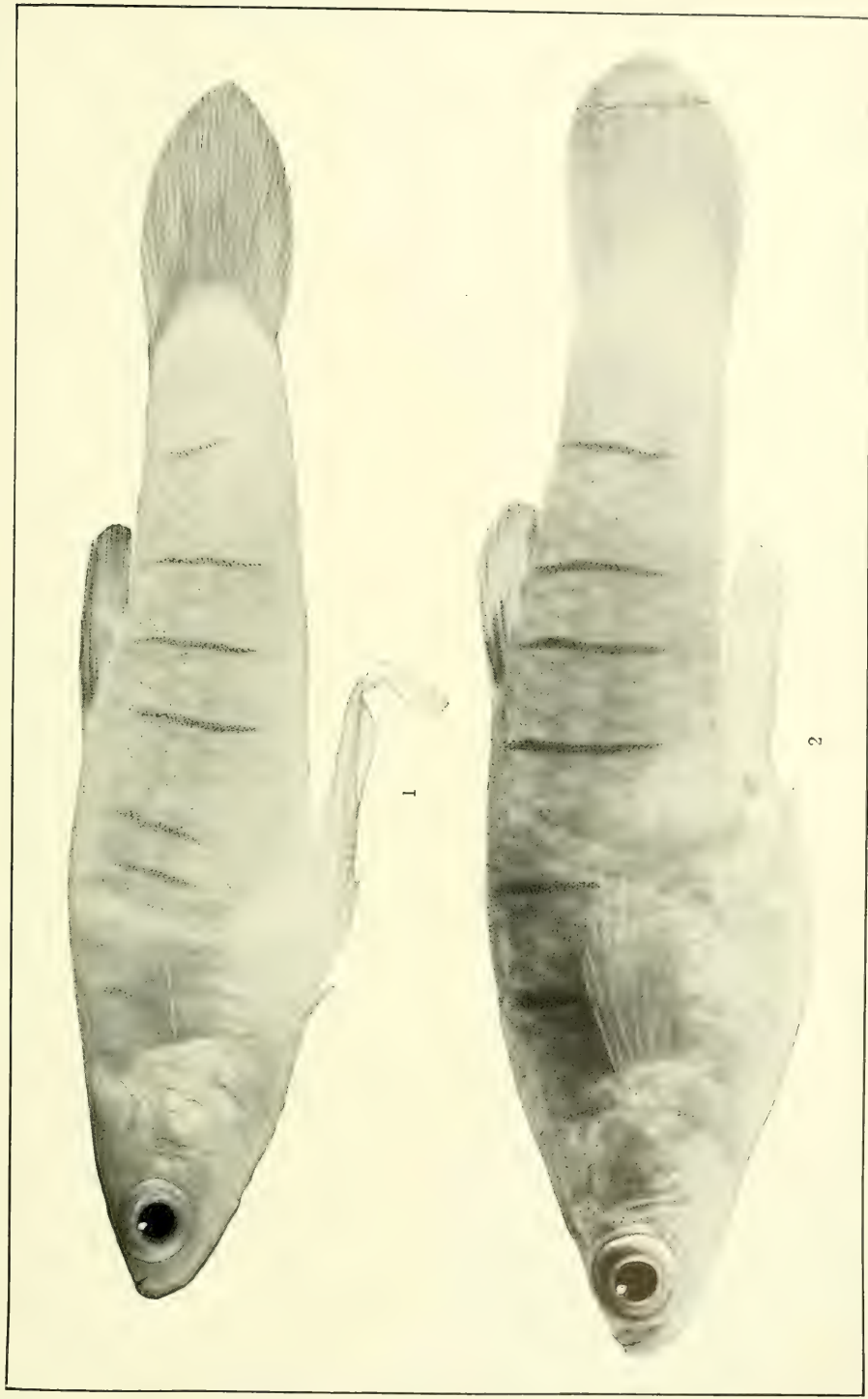


FIG. 1. *Phallotorynus fasciolatus* Henn. ♂. Type, No. 3752, C. M. 20 mm. Jacarehy.  
 FIG. 2. *Phallotorynus fasciolatus* Henn. ♀. Paratype, No. 3754 h. C. M. 28.5 mm. Jacarehy.



## X. A NEW SPECIES OF APATOSAURUS.

BY W. J. HOLLAND.

In the Carnegie Quarry, near Jensen, Utah, the Carnegie Museum among other specimens has recovered a remarkably perfect skeleton, which is provisionally referred to the genus *Apatosaurus*.

The specimen consists of a series of vertebræ, complete from the atlas to nearly the end of the tail. From the anterior dorsals to the posterior caudal vertebræ the bones were found lying *in situ*, but slightly dislocated. Possibly eight or ten posterior caudals are missing. The tail is very long and contains at least seventy-three vertebræ, of which sixty-four were recovered. The cervical vertebræ had been separated from the dorsals and shifted, but the entire series was found articulated in regular order. The limb bones were found approximately in place, one of the femora being articulated in the acetabulum. The entire left fore limb was found with the bones articulated. The femur, tibia, and fibula of the right hind limb the left femur and the left hind foot were also found. The foot was articulated. The ribs were approximately in position. The whole specimen has been mounted, save that the skull has not as yet been supplied. A skull, which, judging from its location, belongs to the specimen, was found within eleven feet of the atlas. It does not differ greatly in form from the skull which belongs to *Diplodocus*, but is much larger than any skull of the latter genus known to the writer. I have already in a previous article (ANNALS CARNEGIE MUSEUM, Vol. IX, p. 273) called attention to the uncertainty which exists as to the skull of *Apatosaurus*, and will not renew the discussion in this paper, believing it more prudent to await the result of excavations which are now being carried on, and which promise perhaps to yield positive information as to this matter. Mr. Douglass is at present taking up the remains of another specimen, somewhat smaller than the one which has been mounted in the Carnegie Museum, and which seems to be lying *in situ*. He has not yet reached the region of the cervicals, but is not without hope that the head of this specimen may be found attached to the vertebræ. It seems prudent therefore

to refrain from further remarks as to the nature of the skull of *Apatosaurus*, in the hope that more light may be soon thrown upon the subject.

It should be stated that the writer has in preparation a large monographic paper relating to the genus, based in part upon the specimen specifically described in this paper, the publication of which has been held back, partly in order that the plates and illustrations which are to accompany it may be prepared.

*Apatosaurus louisæ*, sp. nov.

**Type:** No. 3018, Carnegie Museum Catalog of Fossil Vertebrates.

**Locality:** Carnegie Quarry, near Jensen, Uinta County, Utah.

**Horizon:** Upper Jurassic (Morrison Beds).

The differences between the present species and *Apatosaurus* (*Brontosaurus*) *excelsus*, which reveal themselves in many of the minor details of structure, such as the position and form of the laminae supporting the transverse processes of the dorsal vertebræ, are multitudinous, but may perhaps in part be attributed to individual variation. Of these differences I shall not speak in the present paper. A few of the specific characters which will facilitate the recognition of the species are the following:

1. The lateral cavities in the centra of the dorsals do not have their openings situated at the middle of the centrum, as in *A. excelsus*, but they are located higher up, at the base of the pedicle of the neural arch, and open inwardly and downward, forming deep pocket-like cavities.

2. The round hemispherical articulating surface of the anterior ends of the centra, which are well-developed in the first five dorsal vertebræ of *A. excelsus*, appear only in the first two dorsals of *A. louisæ*, being feebly indicated in dorsal No. 3, after which all the centra in *A. louisæ* have their anterior articulating surfaces platyan.

3. Whereas in *A. excelsus* Marsh, and in another specimen belonging to the Carnegie Museum, referred to *excelsus* by Hatcher, and coming from the same horizon in Wyoming from which Professor Marsh obtained the type, there is a large foramen piercing the lateral transverse laminae on either side of the anterior three caudals above the level of the neural canal, such openings do not occur in the type specimen of *A. louisæ*. This causes the bones to present a very different appearance from those of the type of *A. excelsus* when viewed either from before or behind.

•

4. The facets for the attachment of the capitulum of the ribs in the dorsals are much lower down in *A. excelsus* than in *A. louisæ*. This fact also imparts to the vertebræ when compared with each other a very different appearance.

5. The neural spines of the caudals at the middle of the tail in *A. louisæ* are more erect, more nearly approaching the perpendicular, than in *A. excelsus*, as represented in the specimen in the Carnegie Museum, as well as in the type preserved in the Peabody Museum, so far as the material there represented permits comparison.

There are numerous diagnostic characters which the writer does not take up in the present paper, but which he hopes to be able shortly to present in the larger publication already referred to.

The type is fully adult, as is shown not only by its great size, but by the complete coössification of the pubic and ischial bones where they unite in forming the acetabulum, and also by the coössification of the pubic and ischial bones at their distal extremities.

The species is named in honor of Mrs. Andrew Carnegie.



## XI. THE BIRDS OF THE ISLE OF PINES.

By W. E. CLYDE TODD.

INCORPORATING THE SUBSTANCE OF FIELD-NOTES BY GUSTAV A. LINK.

(PLATES XXII-XXVII.)

### INTRODUCTION.

Although the West Indian Islands were among the first regions of the New World to be visited by explorers with a scientific turn of mind, their fauna thus early becoming known to the naturalists of Europe, and although subsequent researches have greatly increased our knowledge, it is only in comparatively recent years that systematic attempts have been made to investigate the islands from the standpoint of the zoögeographer, and with the same painstaking care as has been used in the case of certain sections of continental America. The West Indian Islands present a most inviting field for further investigation and, indeed, so far as their avifauna is concerned, an exhaustive treatise on the subject remains to be written. The importance of a study of island-life, considered in its bearing upon the various problems connected with the evolution of species, and their present distribution and relationships, has during the past four decades come to be realized. It is more and more felt that the study of the organism in relation to its environment, constituting the new science of ecology, is of equal importance with the study of form and function, and that carefully recorded data as to the habits and life-history of a given species are often more valuable, even from the standpoint of the pure systematist, than a large series of finely prepared and accurately labelled specimens.

It is with such considerations as these in mind that the present paper has been prepared, and is submitted as a contribution to a faunal survey of the West Indies, along lines similar to those followed by the writer in an earlier paper on the ornithology of the Bahama Islands (ANNALS CARNEGIE MUSEUM, VII, 1911, 388-464). It is primarily based on a collection of birds made in the Isle of Pines by Mr. Gustav A. Link, of the taxidermic force of the Carnegie Museum,

during his residence there for a year, beginning in June, 1912. Mr. Link is entitled to great credit for making such a fine collection, working as he did under unusual embarrassments, due in part to ill health, on account of which he had been ordered by his physician to a warmer climate. Although he succeeded in covering the island fairly well, it is to be regretted that he was unable to devote more time to the investigation of the southern coast and the eastern part of the Cienaga, or Central Swamp, the avifauna of which sections proved to be unusually interesting. Unfortunately, too, because of inexperience in recording observations, his field-notes are somewhat meager, and leave much to be desired. In many cases they have been supplemented in the preparation of this paper by the published observations of other parties, particularly those of Mr. Arthur C. Read, a local observer, and the late Mr. Walter R. Zappey. Under each species all published references have been collated, so far as they relate to the Isle of Pines.

In addition to the material brought back by Mr. Link, the writer has had the opportunity of examining many of the more interesting specimens collected by Mr. Zappey in 1904, for which privilege he is indebted to Mr. Outram Bangs. The critical study and comparison of this new material has served to fix with greater certainty a number of doubtful cases of status and relationships among the forms involved, while it has also incidentally revealed the existence of some additional geographical variants in the adjoining island of Cuba. It is evident that much remains to be done even in Cuba before a full and accurate understanding of its ornis can be reached. For the loan of specimens from the West Indies for use in this connection the writer is indebted not only to Mr. Bangs, as mentioned, but also to Mr. Charles T. Ramsden, of Guantánamo, Cuba, Mr. Frank M. Chapman, of the American Museum of Natural History, Mr. Charles B. Cory, of the Field Museum of Natural History, and Dr. Charles W. Richmond, of the U. S. National Museum. He is further under obligations to Messrs. William Palmer and Joseph H. Riley for the use of their field-notes made during a visit to the Isle of Pines in 1900, and to Mr. Riley and Dr. Richmond for additional data and information. Mr. Robert Ridgway has very generously permitted him to describe here the new form of *Columba inornata* from the Isle of Pines in advance of the appearance of the forthcoming part of that author's *Birds of North and Middle America*, while Dr. Jonathan Dwight, Dr. Louis B. Bishop, and Mr. Henry

W. Henshaw have kindly furnished measurements of certain specimens from collections under their care. Miss Sophie G. Keenan, of Nueva Gerona, Isle of Pines, has courteously supplied some much needed information concerning sundry localities, together with an authentic map of the island. Dr. Otto E. Jennings, Curator of Botany in the Carnegie Museum, is responsible for that part of the present paper which deals with the physiographic and major botanical features of the island. And finally, acknowledgments are due to Mr. Arthur C. Read, of Santa Barbara, Isle of Pines, for a set of his articles on birds published in a local newspaper, and for his cheerful compliance with requests for information concerning his work.

#### GEOGRAPHY AND PHYSIOGRAPHY.

The Isla de Pinos, or Isle of Pines, lies off the southern coast of Cuba, to which it belongs both politically and geographically. It is situated about midway of the concavity formed by the western end of that island, from the nearest point of which it is distant only about thirty-five miles, while the channel between is dotted with numerous small islands or cays. Its area is approximately eight hundred square miles, and its outline roughly rectangular, with the corners cut off. On the west coast there is a deep indentation, known as Sigüanea Bay, and a smaller one on the east coast, directly opposite. Between these two inlets stretches an immense fresh-water morass, the Ciénaga de Lanier, which divides the island from east to west into two parts, the southern portion being approximately one-half the size of the northern. The latter is irregularly oblong in shape, about twenty-five miles in an east and west direction by twenty miles north and south. The southern portion is about thirty-five miles long and not over eight miles across at the widest part, with its western end curving to the northwest, around Sigüanea Bay, for a considerable distance beyond the westernmost point of the northern portion. The "south coast," as it is called, is almost uninhabited and very imperfectly known, but the northern portion of the island has been laid out into tracts of greater or less size, some of which have been cleared and given over to the cultivation of citrus-fruits, pineapples, etc. The total population is said to be about four thousand, and Nueva Gerona, in the north-central part of the island, is the principal town, between which and Batabanó, Cuba, there is regular communication by steamer.

The surface of the northern portion of the island consists of an essentially level plain, from which rise abruptly a number of isolated mountain ridges and peaks, constituting prominent landmarks. Of these ridges the best known are the two in the neighborhood of Nueva Gerona, running parallel with each other in a general north and south direction, on either side of the town. The ridge lying to the westward is known as the Sierra de Casas or Casas Mountains (Pl. XXII, fig. 1), while the eastern and longer ridge is the Sierra de Caballos or Caballos Mountains, which extend out into the sea to the northward in a high rocky promontory, Punta del Colombo. The Caballos Mountains reach a height in some places of about a thousand feet, the Casas Mountains being considerably lower. Geologically speaking, these ridges are composed mainly of a crystalline marble, the strata dipping to the east-northeast, so that the western slopes are generally steeper than the eastern, with precipitous cliffs exposed in many places. Elsewhere the slopes are covered from base to summit with a dense tangle of partly deciduous vegetation (Pl. XXII, fig. 2). Among the prominent forest-trees are *Casearia sylvestris*, *Trichilia hirta*, *Amyris balsamifera*, *Banisteria laurifolia*, *Spondias Monbin*, and *Guazuma Guazuma*. Everywhere the trees are looped with vines, while their upper and more exposed branches are covered with air-plants of various kinds, and the ground beneath is choked with bushes and herbaceous growths. In these woody tangles, especially near the foot of the mountains, the most characteristic bird is perhaps the Isle of Pines Lizard Cuckoo, while among the other species partial to this particular habitat may be mentioned the Ani, Red-legged Thrush, Black-whiskered Vireo, Cuban Tody, Cuban Spindalis, Ricord Emerald, and Isle of Pines Pygmy Owl. A little higher up on the slopes the Isle of Pines Trogon becomes fairly common, while among the cliffs near the summit, where the trees begin to thin out, the Cuban Cliff Swallow and Turkey Buzzard are accustomed to nest.

Besides the two ridges just described, there is another, the Sierra de la Cañada or Cañada Mountains, in the southwestern part of the northern section of the island, a few miles east of Los Indios. This is almost as high as the Caballos ridge, but unlike it is composed of an impure mica schist, the southwestern exposure being quite steep and precipitous. It is covered with a sparse growth of pines (*Pinus caribæa*) and star-palms (*Coccothrinax Miraguano*), and from its foot a level sandy or gravelly plain, supporting a similar open pine-forest, stretches away



to the western coast. Indeed, this sandy, pine-covered plain occupies the entire southwestern portion of the northern island, as far north almost as Santa Barbara. Excepting for a fringe along the streams, where the prevailing vegetation is of a different kind, denser and more jungle-like, the pines are very characteristic of this section (Pl. XXIV, fig. 1). The bird-life here, however, is neither rich nor varied. These open pine-lands are the favorite haunts of the Cuban Crane and several species of pigeons and doves, but barring the La Sagra Fly-catcher, Gray Kingbird, and certain winter-resident species of warblers in their season, birds are rather scarce.

Over the greater portion of the northern island, however, the soil is largely the Mal Pais Gravel, a yellowish red or brownish red gravelly clay, which becomes very firm during the dry season, and which in depressions is replaced by a light yellow or somewhat gray sandy loam. Over much of this part of the inland plain, as for instance in the vicinity of Nueva Gerona and Santa Fé, the land has been in use at least for grazing purposes for a long time, and the original vegetation has been greatly modified. Bush-fires have frequently been started as a means of clearing the land, and at the present time considerable areas are under cultivation. In these cultivated tracts are found the Cuban Meadowlark, Isle of Pines Lizard Cuckoo, and Isle of Pines Woodpecker, with an occasional flock of the Isle of Pines Grackle, but few other of the woodland species have occasion to venture into such situations. Outside of these cultivated areas the vegetation is mainly a palmetto-pine scrub (Pl. XXIII, fig. 1), partly deciduous in the dry season, and in the lower spots quite dense and difficult to penetrate. As a rule this straggling shrubbery is from eight to fifteen feet in height, and among others the following species are represented: *Curatella americana* (sandpaper leaf), *Byrsonima crassifolia*, *Tabebouia lepidophylla*, *Brya ebenus* (known locally as "majagua," and forming dense thorny thickets), and several kinds of palmetto. Mixed with these, but rising considerably above the general level of the shrubby vegetation, are varying numbers of *Pinus caribæa* (Caribbean Pine), *Muntingia calabura*, *Coccothrinax Miraguano* (star-palm), *Sabal parviflora* (cabbage-palm), *Paurotis Wrightii* (bottle-palm) (Pl. XXIII, fig. 3), and *Copernicia Curtisii*, and in the lower places *Oreodoxia regia* (royal palm) (Pl. XXIII, fig. 2). The Isle of Pines Parrot, Isle of Pines Woodpecker, and Cuban Sparrow Hawk are characteristic birds in this sort of country, while certain other species,

such as the Cuban Quail, Cuban Oriole, Cuban Mourning Dove, Cuban Ground Dove, and three species of flycatchers—the Cuban Petchary, Gray Kingbird, and La Sagra Flycatcher — are also more or less common here, as well as in the thickets on the mountain side. In the more open situations, and along the edges of the scrubby growth, are found the Cuban Meadowlark and Yellow-faced Grassquit.

The rivers of the northern island diverge in every direction from the central plain, from which to the seacoast there is a fall of about two hundred feet. The Rio de las Nuevas, or New River, is the largest of these streams, and drains an extensive area in the northwestern part. All the rivers are very low in the dry season, some of them, indeed, being reduced to a mere succession of pools, the channels then being called "arroyos." "There appears to have been in recent times an elevation of the island sufficient to have enabled the streams to cut down steep channels, at least in the lower part of their courses, so that subsequent depression to the present level has resulted in submerging the lower courses of the rivers, thus making them subject to tide-water for often eight or nine miles from the mouth. The forests of the mangrove formation have at the same time advanced upon the lower parts of the depressed plain" (Jennings, *American Fern Journal*, I, 1911, 131). This mangrove-swamp, which is so characteristic a feature of numerous other islands and coasts about the Gulf of Mexico, forms a fringe around the greater part of the Isle of Pines (Pl. XXIV, fig. 2), and extends inland along the river-courses for several miles, or until the water becomes fresh. Two species are represented, *Rhizophora mangle*, the true mangrove, and *Avicennia nitida*, the white mangrove, growing together in a dense and tangled mass, extending well out into the water. There is a chain of islands lying off to the northwest from Punta del Potrero on the east coast which are composed entirely of this mangrove growth, while the islands in Sigüanea Bay are also of the same formation. The Cuban Yellow Warbler is entirely confined to the mangroves, and they are the favorite haunts of the Isle of Pines Clapper Rail, and several species of herons and other water-birds.

Above tidewater the river-bank fringe of mangroves gives way as the land rises to a jungle-like growth with considerable low vegetation and many vines. The trees are mainly evergreen species, among which are *Anona squamosa*, *Hirtella mollicoma*, *Morinda Roioc*, *Eugenia punicifolia*, etc. This same jungle, with modifications, extends also



along the banks of the arroyos, becoming less dense and less evergreen on the drier ground. Here occur such trees as *Xylopia grandiflora*, *Pithecolobium arboreum*, *Dendropanax cuneifolium*, *Tetrazygia bicolor*, and *Ternstræmia obovalis*. On the low plain back of the mangroves, as for instance along the coast north of Nueva Gerona, there is a considerable seepage even during the dry season from the higher ground, so that this same fresh-water jungle occurs in many cases as an inner fringe to the mangrove forest, and may even be found also along the north side of the Cienaga de Lanier. It is in this dense tropical jungle that bird-life is most abundant and varied. Here occur as representative species the Isle of Pines Green Woodpecker, Cuban Wood Pewee, Black-whiskered Vireo, Isle of Pines Pygmy Owl, Isle of Pines Trogon, Ricord Emerald, Red-legged Thrush, and Cuban Spindalis, in addition to numerous other less common kinds, while several species of winter-resident warblers find here congenial haunts in their season.

Lagoons and marshes are not infrequent in certain parts of the northern island, especially near the coast, and several of the larger of these were visited on one or more occasions by Mr. Link. A large lagoon on the Bibijagua tract, near Punta Primera de Salinas, proved to be a favorite resort for several species of shore-birds, its sandy and muddy southern beach being a great attraction. So much of the actual coast-line of the island is taken up with the mangroves that there are comparatively few stretches of beach, one of the most extensive of which lies to the east of Punta de la Bibijagua. The lagoon just referred to, known locally as " Rincon " Lagoon, lies a little way behind this beach, parallel with the shore-line. It is quite shallow, and the water is brackish, supporting in places a growth of aquatic plants, and fringed in others with the inevitable mangroves. The El Bobo Lagoon, which lies just east of the mouth of the Nuevas River, is of a similar character, being an area of shallow, brackish water closed in by mangroves and receiving an overflow from the sea at very high tide. Santa Rosalia Lagoon, which is situated just south of the Caballos Mountains not far from the town of Columbia, is of a different character, the water being fresh, the shores muddy, and with a rank growth of marsh-grasses farther back. All these lagoons become very low in the dry season. They are favorite resorts for the various species of herons and certain other aquatic birds.

The Cienaga de Lanier, the great marsh which extends across the

southern part of the Isle of Pines, virtually dividing it into two islands, partakes largely of the character of the coast for some distance from its western end, and probably at its eastern end also. The water is more or less brackish, and the mangroves follow up this condition. Towards the central portion, however, the water becomes fresh, and even at the Paso de Piedras, the only available crossing-place, it is two or three feet deep in the dry season. In its general character this great swamp closely resembles the Florida Everglades (Pl. XXV, fig. 1). Marshy areas with grasses and sedges alternate with open shallow pools filled with water-lilies, or, on the other hand, with island-like "hummocks," supporting a dense growth of broad-leaved shrubs, low trees, and palms. As might naturally be expected, the Cienaga has a very characteristic bird-fauna of its own, some species, as for example the Cuban Red-wing and Purple Gallinule, being practically confined to its limits. Herons of several kinds, the White Ibis, Cuban King Rail, Limpkin, Antillean Tree Duck, and West Indian Jacana are among the birds commonly observed here. It is to be regretted that there was not sufficient time to give this interesting region a more thorough investigation.

South of the Cienaga lies the "south coast"—a region quite different in character from the main island, consisting of a fairly level coral-limestone formation, the overlying soil being thin, but rich, supporting in places a tangle of broad-leaved, partly deciduous trees, shrubs, and vines, such as *Pithecolobium arboreum*, *Tecoma pentaphylla*, *Metopium toxiferum*, *Bucida Buceras*, and *Lysiloma bahamensis*, some of which are not known from the northern island. There are no pines here, and barring a few cocoanut and royal palms along the coast near habitations, the only palm noticed was *Thrinax Wendlandiana*, which is particularly abundant along the tops of the cliffs facing the sea. Scattered through this section there are numerous good-sized lagoons, only one of which, however, the Laguna de Piedras, a short distance south of Pasadita, was visited by Mr. Link, who reports that it was of the same general character as the Cienaga itself. He was able also to make an overland trip from Bogarona, on Sigüanea Bay, to Caleta Grande, and thence to Caleta Cocodrilos. Along this portion of the coast the surf beats against jagged perpendicular cliffs, which in some places were perhaps eighty or ninety feet in height. A narrow shelf, with numerous projecting jagged rocks, extends out from the coast for a short distance, beyond which the water deepens

very rapidly, the thousand-fathom line lying only about seven miles offshore. Unfortunately it was not possible to explore any of the long stretch of coast-line between Caleta Cocodrilos and Punta del Este (Pl. XXV, fig. 2), which part is considered too dangerous for small vessels to approach, and this remains, ornithologically speaking, a *terra incognita* which is bound to repay future investigation, judging from the indications afforded by the western end. The Cuban Bullfinch was not encountered elsewhere in the island, and the Cuban Crow, Helena Hummingbird, and certain species of shore-birds were also quite numerous. The islands in Siguanea Bay proved to be favorite resorts for certain sea-birds, particularly one known locally as "Bird Island," where is a large colony of Man-o'-war Birds and Florida Cormorants.

#### CLIMATE.

"The climate of the island is, of course, oceanic and quite equable. [This is due to its comparatively small size, exposed position, and level contour, without any high or extensive mountain ridges, such as exert a modifying influence in Cuba, for example.] The latitude being but about twenty-one degrees north, the extreme range of the thermometer lies between about 50° and 100° F. The temperatures experienced by the writer during his sojourn on the island in May, with the sun exactly overhead at noon, were from 82° to 92° F. during the day, while at night, temperatures as low as 70° F. were rarely experienced. The temperature of the ocean water on the beaches was 80°–82° F., while a mineral spring at Santa Fé was said to register 88° F. The well and spring waters, so far as tested, ranged generally from about 68° to 80° F. as they came from the ground. The island has a dry season, with showers very rarely, from November to May, while during the latter month, or about the first of June, there begins a wet season, with torrential rains, which fill to the brim the sharply cut channels of the rivers, and flood portions of the low-lying plains" (Jennings, *American Fern Journal*, I, 1911, 132). Hurricanes visit the island at intervals, doing immense damage to buildings and crops. The island is free from both yellow and malarial fevers, but the hordes of insect-pests make life in the open almost unendurable, except to those inured to such persecution, and are one of the causes for the tardy development of its natural resources. Most of the land is in the hands of companies of promoters, whose roseate representations

are leading many an unwary *bona fide* settler into an unprofitable venture, the potential capacity of the soil being by no means the only factor entering into the case.

#### PREVIOUS WORK.

The well-known Cuban naturalist, the late Dr. John Gundlach, was in January, 1854, apparently the first ornithologist to visit the Isle of Pines. For a period of forty years thereafter his notes, published in various periodicals and sometimes at second-hand, remained our only source of information concerning its avifauna. According to Mr. Cory, to whom he furnished a manuscript list of the birds observed, Gundlach again visited the island in April, 1892, but whether in the intermediate period does not appear. Gundlach, however, failed to recognize the importance of a comparative study of the bird-life of the island, which he evidently regarded as not essentially different from that of Cuba, and while his latest work abounds in references to the Isle of Pines, in almost every case it is merely to mention incidentally the occurrence there of certain Cuban species.

In 1900 Messrs. William Palmer and Joseph H. Riley of the U. S. National Museum, made a brief collecting trip to the island, from June 27 to July 13 inclusive. Practically all of their work was done in the vicinity of Nueva Gerona, except for part of two days which Mr. Palmer spent at Manigua, a plantation about ten miles west of that town, in the pines. A list of fifty-one species was made on this trip; all well-known forms.

In March, 1902, the late Mr. Walter R. Zappey visited the island and made a small collection of birds, which went to the Rothschild Museum at Tring, England, where up to date they have not been reported upon. In 1904, however, the same collector visited the island again, remaining from April 18 to June 4 inclusive. His route appears to have been from Nueva Gerona, Bibijagua, etc., to Santa Fé, El Hospital, and Pasadita to the south coast at Playa Larga, and he seems to have been the first naturalist to visit the Cienaga. His material, amounting to two hundred and sixty-seven specimens, went into the collection of Messrs. E. A. and O. Bangs (now in the Museum of Comparative Zoölogy), and together with his field-notes was the basis of the first systematic account of the birds of the island. In this paper, published in 1905, Messrs. Bangs and Zappey pointed out for the first time the distinctness of several of the birds from the Isle



of Pines, and later Mr. Bangs characterized a few additional forms from the same collection.

In December, 1908, Mr. Arthur C. Read, an enthusiastic amateur ornithologist of Toledo, Ohio, went to the Isle of Pines, where he has ever since resided. He soon began to send back notes for publication, mainly to the *Oölogist* of Albion, New York. Many of his articles are merely lists of species seen at various times and places. Unfortunately, however, in some instances Mr. Read's earlier identifications were erroneous, as is shown by the corrections which he himself makes. Some of the records, which up to the present he has allowed to stand, appear doubtful to the writer, and to have been admitted to his lists on insufficient grounds. In reply to an inquiry addressed to Mr. Read he writes that some of these records which seem open to question were based on the actual capture of specimens, but that the specimens were not in every case preserved; moreover, that he lost his entire collection of skins in the flood and hurricane of 1910, and has not started a new one since. This circumstance is very unfortunate, as it makes it impossible to authenticate the correctness of his determinations in cases of doubt. The list of a part of Mr. Read's collection, and a copy of some of his field-notes, have been kindly loaned by him for examination, and have been freely used in the preparation of the present report.

#### THE EXPEDITION OF 1912-13.

In May, 1910, a party of four from the staff of the Carnegie Museum was engaged for a few weeks in making collections of the plants and reptiles of the Isle of Pines. No particular attention was paid to the birds on this expedition, but, as the island seemed to promise good results for work in this line, Mr. Gustav A. Link of the taxidermic staff of the museum was detailed in 1912 to undertake the making of a representative collection of the birds of the island, and left in June of that year, accompanied by his son, Mr. John Link, as assistant. Beginning work at Nueva Gerona on June 26, he continued until July 12, when interference from the Cuban officials caused a suspension of his activities for over two months. He then went to Los Indios, in the southwestern part of the main island, which he made his headquarters until January 25, 1913, making in the meantime several trips from there to points on Siguanca Bay and the "south coast." Los Indios and its vicinity proved to be a much better collecting-ground than the country about Nueva Gerona, this latter section being so

much more extensively cleared and cultivated than the other. Intermittent work was carried on at Nueva Gerona, however, from January 26 until April 9, the mountains in the vicinity being repeatedly visited, and several side-trips being made to certain lagoons on the north coast in search of water-birds. Returning to Los Indios on April 10, Mr. Link made a second trip to the "south coast," and also put in some time at the western end of the Cienaga, near Sigüanea. May 10 to 21 was spent at Nueva Gerona, after which he undertook a trip to the eastern end of the Cienaga, at Pasadita, where he collected from May 23 to 28, returning to Nueva Gerona the next day, and leaving the island on June 5. The collection of birds brought back amounts to eight hundred and forty-two well-prepared specimens, representing one hundred and three species, including all of the forms peculiar to the island, and a larger series of aquatic forms than most collectors would think of taking.

#### SEASONAL OCCURRENCE.

One hundred and forty-two species are admitted to the present list of the birds of the Isle of Pines, or twenty-two more than were given by Messrs. Bangs and Zappey in 1905. For nearly all of these additions the work of Mr. Link is responsible, and there are specimens to support most of the new records. In every case the evidence for the occurrence of a given species has been carefully weighed, especially with reference to its known status in Cuba, and doubtful records have been relegated to the hypothetical list. A few species have been admitted to the list solely on the basis of Gundlach's records as given by Mr. Cory. The voluminous notes made in the last few years by Mr. Arthur C. Read have somewhat perplexed the writer. Published in an amateur journal, the scientific names in many cases not being given, or else so mangled by the printer as to be almost beyond recognition, and with no indication that the author was aware of the very unusual character of certain of his observations, or of the necessity for their full authentication, there would seem to be ample justification for ignoring them entirely in a paper like the present. Nevertheless in spite of the defects, which are evident, it is plain that the good faith of Mr. Read cannot be called into question, and that there is much of interest and value in his notes. An effort therefore has been made to sift them, utilizing such as seem to rest on a sound basis, and calling attention to such as seem dubious, so that they may either be verified or corrected in the future.



As might be expected in the case of a locality lying so far within the Tropical Zone as the Isle of Pines, its avifauna is composed mainly of two classes of species as regards seasonal status, permanent residents and winter visitants. Ninety-two species are included in the first category, all of which are known, or presumed, to breed in the island, and to remain (as a species) the year around. Not a few of the species in this list, however, are known to be more or less migratory, some of them being more numerous in the dry season, when their numbers are augmented by winter migrants from the north; while others are regularly more abundant, or at least more frequently observed, in the breeding season, most of the individuals retiring at its close to other parts. Some of these forms are more or less local in their distribution. Following is the list:

<i>Colymbus dominicus dominicus</i>	<i>Urubitinga gundlachii</i>
<i>Podilymbus podiceps</i>	<i>Falco sparveriioides</i>
<i>Anhinga anhinga</i>	<i>Polyborus cheriway</i>
<i>Phalacrocorax auritus floridanus</i>	<i>Pandion haliaëtus carolinensis</i>
<i>Phalacrocorax vigua mexicanus</i>	<i>Colinus cubanensis</i>
<i>Pelecanus occidentalis</i>	<i>Rallus elegans ramsdeni</i>
<i>Fregata magnificens</i>	<i>Rallus longirostris leucophæus</i>
<i>Ixobrychus exilis exilis</i>	<i>Gallinula chloropus cachinnans</i>
<i>Ardea occidentalis repens</i>	<i>Ionornis martinica</i>
<i>Ardea herodias adoxa</i>	<i>Aramus vociferus</i>
<i>Herodias egretta</i>	<i>Grus mexicana nesiotes</i>
<i>Dichromanassa rufescens</i>	<i>Sterna maxima</i>
<i>Florida cærulea</i>	<i>Sterna antillarum</i>
<i>Egretta thula thula</i>	<i>Himantopus mexicanus</i>
<i>Hydranassa tricolor ruficollis</i>	<i>Oxyechus vociferus rubidus</i>
<i>Butorides virescens cubanus</i>	<i>Pagolla wilsonia wilsonia</i>
<i>Butorides brunescens</i>	<i>Jacana spinosa violacea</i>
<i>Nycticorax nycticorax nævius</i>	<i>Starnænas cyanocephala</i>
<i>Nyctanassa violacea</i>	<i>Geotrygon chrysia</i>
<i>Ajaia ajaja</i>	<i>Geotrygon montana</i>
<i>Guara alba</i>	<i>Chæmepelia passerina aflavida</i>
<i>Mycteria americana</i>	<i>Zenaida zenaida zenaida</i>
<i>Phænicopterus ruber</i>	<i>Zenaidura macroura macroura</i>
<i>Dendrocygna arborea</i>	<i>Columba leucocephala</i>
<i>Cathartes aura aura</i>	<i>Columba squamosa</i>
<i>Rostrhamus sociabilis</i>	<i>Columba inornata proxima</i>

<i>Ara tricolor</i>	<i>Tyrannus cubensis</i>
<i>Aratinga euops</i>	<i>Tolmarchus caudifasciatus</i>
<i>Amazona leucocephala palmarum</i>	<i>Myiarchus sagræ sagræ</i>
<i>Crotophaga ani</i>	<i>Blacicus caribæus</i>
<i>Saurothera decolor</i>	<i>Mimus polyglottos orpheus</i>
<i>Glaucidium siju vittatum</i>	<i>Myadestes elisabeth</i>
<i>Gymnasio lawrencii exsul</i>	<i>Mimocichla rubripes rubripes</i>
<i>Asio stygius</i>	<i>Corvus nasicus</i>
<i>Tyto perlata furcata</i>	<i>Vireo gundlachii gundlachii</i>
<i>Setochoalcis cubanensis</i>	<i>Petrochelidon fulva fulva</i>
<i>Todus multicolor</i>	<i>Teretistris fernandineæ</i>
<i>Xiphidiopicus percussus insulæ-</i> <i>pinorum</i>	<i>Dendroica petechia gundlachi</i>
<i>Centurus superciliaris murceus</i>	<i>Sturnella magna hippocrepis</i>
<i>Priotelus temnurus vescus</i>	<i>Agelaius assimilis</i>
<i>Streptoprocne zonaris pallidifrons</i>	<i>Icterus hypomelas</i>
<i>Tachornis phænicobia yradii</i>	<i>Ptiloxena atroviolacea</i>
<i>Calypte helenæ</i>	<i>Holquiscalus caymanensis dispar</i>
<i>Riccordia ricordii ricordii</i>	<i>Spindalis pretrei</i>
<i>Tyrannus dominicensis domini-</i> <i>censis</i>	<i>Melopyrrha nigra</i>
	<i>Tiaris olivacea olivacea</i>
	<i>Tiaris canora</i>

Of true summer residents there appear to be only three species, as follows:

<i>Chordeiles virginianus minor</i>	<i>Progne cryptoleuca</i>
<i>Vireosylva calidris barbatula</i>	

This makes a total of ninety-five species known, or reasonably presumed, to breed in the island, or two-thirds of its known ornithology.

There are forty-two species which occur as winter visitants from continental North America. Further work in the island should result in adding a considerable number to this list, judging from the many records of this class from Cuba and the other Antilles. That practically all the migratory birds which regularly or casually visit Cuba should likewise reach the Isle of Pines seems entirely probable. Several of the birds in the following list have been observed more frequently during the season of migration than through the winter months.

<i>Pelecanus erythrorhynchos</i>	<i>Querquedula discors</i>
<i>Botaurus lentiginosus</i>	<i>Chen hyperborea nivalis</i>

<i>Circus hudsonius</i>	<i>Mimus polyglottos polyglottos</i>
<i>Falco peregrinus anatum</i>	<i>Dumetella carolinensis</i>
<i>Falco columbarius</i>	<i>Polioptila cærulea cærulea</i>
<i>Fulica americana</i>	<i>Vireo griseus griseus</i>
<i>Sterna sandvicensis acuflavida</i>	<i>Setophaga ruticilla</i>
<i>Gallinago delicata</i>	<i>Geothlypis trichas trichas</i>
<i>Limnodromus griseus griseus</i>	<i>Seiurus noveboracensis notabilis</i>
<i>Pisobia minutilla</i>	<i>Seiurus aurocapillus</i>
<i>Totanus melanoleucus</i>	<i>Dendroica palmarum palmarum</i>
<i>Totanus flavipes</i>	<i>Dendroica discolor</i>
<i>Catoptrophorus semipalmatus semi-</i> <i>palmatus</i>	<i>Dendroica dominica dominica</i>
<i>Actitis macularia</i>	<i>Dendroica virens</i>
<i>Squatarola squatarola</i>	<i>Dendroica coronata</i>
<i>Oxyechus vociferus vociferus</i>	<i>Dendroica cærulescens cærulescens</i>
<i>Charadrius semipalmatus</i>	<i>Compsothlypis americana usneæ</i>
<i>Arenaria interpres morinella</i>	<i>Mniotilta varia</i>
<i>Antrostomus carolinensis</i>	<i>Passerina cyanea</i>
<i>Streptoceryle alcyon alcyon</i>	<i>Ammodramus savannarum aus-</i> <i>tralis</i>
<i>Sphyrapicus varius varius</i>	<i>Passerculus sandwichensis savanna</i>

The remaining five species belong to the class of transient visitants, appearing only during the migrations in spring and fall, on the way to and from their breeding-grounds. Future research may add a number of species to this list also.

<i>Hirundo erythrogastra</i>	<i>Chordeiles virginianus virginianus</i>
<i>Dendroica striata</i>	<i>Dolichonyx oryzivorus</i>
<i>Tringa solitaria</i>	

#### FAUNAL AFFINITIES.

Geographically speaking, the Isle of Pines is so closely related to Cuba that a rise of only about fifty feet would suffice to connect the two islands. Even now the channel between is dotted with numerous cays, forming a chain of islands which would surely present no especial difficulties to the passage of birds, even those of weak flight. It does not appear whether the Isle of Pines received its bird population from Cuba in this manner, or before its separation from that island took place; in either case we would expect to find their respective avifaunas closely related. An analysis shows that of the one hundred and twenty-six species on the list of breeding birds for western Cuba, no

less than eighty-five are common to both islands, while eight others are represented in the Isle of Pines by recognizably distinct forms, at least one of which is so different from the original-stock form as to merit (in the writer's judgment) the rank of a species. These Cuban forms, with their respective representatives in the Isle of Pines, are as follows:

## WESTERN CUBA.

*Rallus longirostris cubanus*  
*Columba inornata inornata*  
*Amazona leucocephala leucocephala*  
*Saurothera merlini*  
*Glaucidium siju siju*  
*Xiphidiopicus percussus percussus*  
*Centurus superciliaris superciliaris*  
*Priotelus temnurus temnurus*

## ISLE OF PINES.

*Rallus longirostris leucophæus*  
*Columba inornata proxima*  
*Amazona leucocephala palmarum*  
*Saurothera decolor*  
*Glaucidium siju vittatum*  
*Xiphidiopicus percussus insula-pinorum*  
*Centurus superciliaris murceus*  
*Priotelus temnurus vescus*

On the other hand, there are at least thirty-one species of western Cuban breeding birds which have not as yet been recorded from the Isle of Pines, as follows:

* <i>Sula leucogastra</i>	* <i>Sterna anæthæta</i>
* <i>Phaëthon americanus</i>	* <i>Sterna dougalli</i>
* <i>Plegadis autumnalis</i>	* <i>Larus atricilla</i>
* <i>Erismatura jamaicensis</i>	* <i>Hæmatopus palliatus</i>
* <i>Nomonyx dominicus</i>	<i>Geotrygon caniceps</i>
* <i>Aix sponsa</i>	* <i>Melopelia asiatica asiatica</i>
* <i>Pæcilonetta bahamensis</i>	<i>Campephilus bairdii</i>
<i>Chondrohierax wilsonii</i>	<i>Nesocelus fernandinæ</i>
<i>Buteo borealis umbrinus</i>	<i>Colaptes 'chrysocaulosus chryso-</i>
<i>Buteo platypterus cubanensis</i>	<i>caulosus</i>
<i>Accipiter gundlachi</i>	<i>Nephæcetes niger niger</i>
<i>Accipiter striatus fringilloides</i>	<i>Corvus minutus</i>
<i>Limnopardalus maculatus inop-</i>	<i>Dendroica pityophila</i>
<i>tatus</i>	<i>Cyanerpes cyaneus ramsdeni</i>
* <i>Porzana flaviventris</i>	<i>Agelaius humeralis</i>
* <i>Anous stolidus stolidus</i>	<i>Ammodramus savannarum subsp.</i>
* <i>Sterna fuscata</i>	

Almost half of the species in this list (designated by an asterisk) are of more or less wide distribution, so that their absence is of no especial significance. No doubt in due time a number of them will be found in the Isle of Pines. Just how far a like probability may be

assumed for the remaining forms is an open question. At all events, negative evidence must count for little at present, and the chances are that, other conditions being equal, the majority of the species of this latter category extend their range to the Isle of Pines. Some of them, indeed, have even been reported therefrom, on what appears at present, however, to be insufficient grounds.

The avifauna of Cuba itself, it may be noted in passing, is not entirely homogeneous, there being at least six cases (two of which are pointed out for the first time in the present paper) where the eastern and western parts of the island respectively are inhabited by different although closely allied forms of certain birds. Without exception in such cases the Isle of Pines bird is like that of western Cuba. So that, while we might perhaps be inclined to accept the theory of isolation as the dominant factor in the development of the distinctive races of the Isle of Pines, it is evident that such an explanation will not account for the differentiation of two distinct forms in Cuba. It is altogether likely, therefore, that the actual difference in environmental conditions in the Isle of Pines, as evidenced in its peculiar physiographic and climatic features, as compared with those of Cuba, has had more to do in the evolution of its several indigenous forms of birds than mere segregation.

#### LIST OF LOCALITIES.

In order to facilitate the use of the map which accompanies this report in studying the local distribution of the avifauna, all the locality names appearing in the text are here duly listed, with a brief indication of their position and application. The American invasion of the island is responsible for the confusing mixture of English and Spanish names. Certain names appearing in Messrs. Bangs and Zappey's paper, too, are incorrectly spelled, while others are of more or less uncertain application. A map furnished by Mr. Link, showing his route and collecting-stations, happily puts his work on a much better basis in this respect.

*Almacigos*.—More properly *Los Almacigos*, which see.

*Arroyo del Pino* (*Pine River*).—A river in the western part of the main island, visited by Mr. Read on a few occasions.

*Arroyo* (" *Rio* ") *Santiago*.—A small river or creek flowing into the Cienaga near its eastern end, referred to by Mr. Zappey.

*Bibijagua* (or *Vivijagua*).—A town-site, with a hotel and several



concrete houses, situated on the north coast about a mile and a half southeast of the point of the same name. There is a sandy beach about a mile long at this place, while immediately to the westward a wooded ridge, which reaches a height of two hundred and fifty feet, runs parallel with the shore-line. The slopes of this ridge were well explored by Mr. Link, and proved to be quite rich in bird-life, and the locality was visited by Mr. Zappey also, who incorrectly spells the name "Bibeyhagua."

*Bird Island*.—A small mangrove island in the southern part of Siguanea Bay, so called because of the presence there of nesting colonies of the Man-o'-war-bird and Florida Cormorant. Visited by Mr. Link on two occasions, and more recently by Mr. Read.

*Bogarona*.—A landing on the south coast of Siguanea Bay, used by vessels plying to and from Los Indios. Mr. Link collected a few specimens at this place.

*Caballos Mountains*.—See *Sierra de Caballos*.

*Cabo (Punta) Frances*.—The western extremity of the "south coast," at the entrance to Siguanea Bay.

*Caleta Cocodrilos (Crocodile Inlet)*.—A small inlet, fringed with mangroves, on the western part of the "south coast," visited by Mr. Link.

*Caleta Grande (Grand Inlet)*.—A small bay or inlet on the "south coast," near its western end, visited by Mr. Link. A sandy beach all around makes this a favorite resort for several species of shore-birds in season, while Brown Pelicans also find it a good place to pursue their fishing.

"*Callebonita*."—A misspelling for *Cayo Bonito*, which see.

*Cañada Mountains*.—See *Sierra de la Cañada*.

*Casas Mountains*.—See *Sierra de Casas*.

*Casas River*.—See *Rio Sierra de Casas*.

*Cayo Bonito*.—An old plantation, lying along a river of the same name, within a mile of the town of Santa Fé. Erroneously given as "Callebonita" by Messrs. Bangs and Zappey.

*Cayo Frances*.—A small island just off Cabo Frances, where Mr. Link once made a brief stop, collecting a few birds. It is almost surrounded with mangroves, but has a stretch of sandy beach.

*Cerro de Santa Barbara (Santa Barbara Mountain)*.—An isolated hill in the western part of the island, about two hundred feet high, referred to by Mr. Read.



*Cienaga de Lanier*.—Usually referred to merely as the "Cienaga." An immense swamp or morass, running from east to west across the southern part of the island, and separating it into two portions. See description on page 152.

*Columbia*.—An American colony or town in the northeastern part of the main island, west of the Rio Jucaro.

*Crocodile Inlet*.—See *Caleta Cocodrilos*.

*El Bobo Lagoon*.—A good-sized salt-water mangrove lagoon near the coast, east of the mouth of the Nuevas River. A favorite resort for various species of herons and shore-birds. Visited by Mr. Link on March 14 and 15, 1913.

*El Canal*.—A tract of land in the southern part of the main island, traversed by Mr. Link in his trip to the Cienaga in May, 1913.

*El Hospital*.—A tract of land adjoining El Canal on the south, traversed by both Mr. Zappey and Mr. Link.

*Ensenada de la Siguanea (Siguanea Bay)*.—A large but comparatively shallow bay indenting the western part of the island, and opening to the northwest. It is about ten miles wide by fourteen miles long, and its shores are almost everywhere fringed with mangroves, while mangrove islands line its southern shore.

*Grand Inlet*.—See *Caleta Grande*.

*Guanabana*.—(Misspelled "Guanawana" by Messrs. Bangs and Zappey). The name applied to a small tract of land just east of Santa Rosalia Lagoon, visited by Mr. Zappey.

*Hato*.—The site of a house on the trail about midway between Bogarona and Caleta Grande, on the "south coast," south of Siguanea Bay. A few birds were collected here by Mr. Link, who reports that the surrounding country is all jungle.

*Hospital*.—More properly *El Hospital*, which see.

*Jacksonville*.—The name applied to a small settlement on the "south coast," about midway between Caleta Grande and Caleta Cocodrilos, visited by Mr. Link.

*Jucaro*.—A landing on the south bank of the river of the same name, used by the steamer plying between the Isle of Pines and Cuba. Visited by Mr. Zappey.

*La Ceiba*.—A fine plantation, about four miles west-southwest of Santa Fé, referred to by Messrs. Bangs and Zappey. The name is applied also, in a larger sense, to the original tract of which this is a part.

*Laguna de Piedras*.—A large lagoon, in character much resembling the Cienaga, situated in the southern portion of the island not far from Pasadita, and visited by Mr. Link on one occasion.

*Laguna Grande*.—The exact position of this lagoon, which was visited by Mr. Zappey, is not ascertainable, but it is evidently near Santa Fé, since birds were shot at both places on the same day, April 21.

*La Vega*.—A contraction, used by Messrs. Bangs and Zappey, of *San Francisco de la Vega*, which see.

*Los Almacigos*.—An extensive tract lying west of the town of Santa Fé, the name being more particularly applied to the old plantation situated near the center of the tract in question. Referred to by Messrs. Bangs and Zappey merely as "Almacigos."

*Los Indios*.—A town-site along the lower course of the river of the same name, in the southwestern part of the main island. This locality was very thoroughly worked by Mr. Link, it being his headquarters, from which excursions were made to surrounding sections, during the greater part of his stay in the island. There are extensive marshes in the vicinity, also areas of dry pasture-land, jungle, pine-woods, etc., with growths of mangrove along the river for a considerable distance from its mouth, and lining a larger salt-water lagoon which lies just back of the coast to the southward. This diversity of conditions makes the locality an ideal one for collecting birds.

*Los Tres Hermanos Mountains*.—A name applied by Mr. Read to the three northernmost peaks of the Casas range, close to Nueva Gerona.

*Majagua River*.—See *Rio de la Majagua*.

*Mal Pais*.—The name applied to the region along the river of the same name, visited by Mr. Zappey.

"*Managua*."—A misspelling of *Manigua*.

*Manigua*.—A famous plantation along the Rio de las Nuevas, a few miles above McKinley, visited by Mr. William Palmer in 1900, in which year it was abandoned.

*McKinley*.—A town-site, with a number of scattering houses, along the Rio de las Nuevas, a few miles from its mouth. It is a locality frequently mentioned in Mr. Read's articles.

*Morrillo del Diablo*.—An island off the north coast, east of the high promontory, Punta del Colombo, and famous as a resort of the Florida Cormorant.

*New River.*—See *Rio de las Nuevas*.

*Nueva Gerona.*—The capital, port of entry, and chief town of the island, situated in the northern part, on the west bank of the Rio Sierra de Casas. It was officially founded in 1830, and now has a population of about twelve hundred. The land in the vicinity of the town is cleared for the most part and some of it is under cultivation, but there remain considerable wooded areas at the base of the Casas Mountains immediately to the westward. Most of the specimens labeled by Mr. Link as coming from "Nueva Gerona" were really secured on the slopes and bases of the Casas and Caballos Mountains, or else along the river above the town. The locality was worked also by Messrs. Palmer and Riley during their visit in 1900, and by Dr. Gundlach in 1854.

*Nuevas River.*—See *Rio de las Nuevas*.

*Pasadita.*—The site of a house which formerly stood on the south shore of the Cienaga, just west of the Paso de Piedras. This house was destroyed in the hurricane of 1910, and at the time of Mr. Link's visit in 1913 the owner had built a new one on the other side of the Cienaga. Mr. Zappey did some collecting here in 1904.

*Paso de Piedras.*—The name given to a stretch of ground about midway of the Cienaga de Lanier, where only it is possible to cross from the main island to the southern part. Even during the dry season the water here is from one to three feet deep, with occasional dry islands.

*Pine River.*—See *Arroyo del Pino*.

*Placer de Playa Larga.*—The name applied to an extensive area of beach and shallows on the southeastern shore of the "south coast." Called "Plaza Larga" by Messrs. Bangs and Zappey.

"Plaza Larga."—See *Placer de Playa Larga*.

*Port McKinley.*—A landing a few miles above the mouth of the Rio de las Nuevas, referred to by Mr. Read.

*Pueblo Nuevo.*—The name given to the inferior "native" suburb, on the western outskirts of Nueva Gerona. Referred to by Messrs. Bangs and Zappey.

*Punta del Colombo.*—A high promontory jutting out into the sea, forming the termination of the Sierra de Caballos.

*Punta del Este.*—The easternmost point of the "south coast." There is an area of sandy beach here, while on the south exposure the same coral rock prevails as is found all over the "south coast" in general.

Very few birds, however, were noticed here on the occasion of Mr. Link's visit, March 22 and 23, 1913. Mr. Zappey seems to have penetrated thus far on his second expedition, since the locality is mentioned once in his report.

*Punta del Potrero*.—The easternmost point of the northern or main island.

*Punta de la Bibijagua*.—A point on the northeastern coast of the island.

*Punta Primera de Salinas*.—A point on the coast, east of Punta de la Bibijagua, which is probably the locality referred to by Messrs. Bangs and Zappey under the name "Salina." It is probably the same as Rincon Lagoon, so called by Mr. Link.

*Punta Frances*.—See *Cabo Frances*.

*Rincon Lagoon*.—A large lagoon adjacent to the coast, east of Bibijagua, visited by Mr. Link, and probably the same as the locality called "Salina" by Messrs. Bangs and Zappey. For a fuller description see page 152.

*Rio de la Majagua (Majagua River)*.—A small river in the southwestern part of the main island, northwest of Los Indios, visited by Mr. Link on several occasions. Like all the rivers of this part, its lower course is fringed with mangroves.

*Rio de las Nuevas (Nuevas or New River)*.—The longest river in the island, draining a large part of the central and northwestern section. It is too shallow, however, to permit the ascent of any but small vessels, and is fringed with mangroves as far up as the town of McKinley, beyond which the jungle comes to the water's edge.

*Rio del Mal Pais*.—One of the tributaries of the Rio Jucaro, rising near the center of the main island, and flowing in a northeast direction.

*Rio Jucaro*.—A good-sized river in the northeastern part of the main island, formed by the junction, near Jucaro, of several smaller streams.

"Rio" *Santiago*.—See *Arroyo Santiago*.

*Rio Sierra de Casas (Casas River)*.—A river in the northern part of the main island, navigable for small steamers for about two miles from its mouth, or to the town of Nueva Gerona.

"Salina."—See *Punta Primera de Salinas*.

*San Francisco de la Vega*.—An unsurveyed tract adjoining the Cienaga, visited in 1904 by Mr. Zappey, who refers to it merely as "La Vega."

*San Juan*.—An extensive tract of land in the eastern part of the main island. The name is also applied, in a more restricted sense, to the old Garcia homestead, the former headquarters of the tract. It is mentioned by Messrs. Bangs and Zappey as a collecting-station.

*Santa Ana*.—A tract of land about four miles west of Santa Rosalia, where Mr. Link found a few species of water-birds at a small lagoon on one occasion.

*Santa Barbara*.—The name originally applied to a tract of about fifteen thousand acres, lying west of the Rio de las Nuevas, but more recently given to a settlement in its south-central part. As used by Mr. Read, the name refers to the tract, but both the tract and the town were formerly called West McKinley by the promoting land-company.

*Santa Barbara Mountain*.—See *Cerro de Santa Barbara*.

*Santa Fé*.—The oldest settlement on the island, situated on the river of the same name, in the east-central part.

*Santa Rosalia*.—A town-site in the northeastern part of the island, about halfway between Nueva Gerona and Santa Fé.

*Santa Rosalia Lagoon*.—A large fresh-water lake, situated a short distance northwest of Columbia, close to the Caballos Mountains. The water is shallow, and during the dry season the lake is of course much reduced in extent. The shores are muddy, and support a rank growth of grasses and sedges. Several species of water-birds were encountered here by Mr. Zappey and Mr. Link.

*Santa Sevilla*.—This locality, mentioned by Messrs. Bangs and Zappey, cannot be found on any map consulted. Possibly it is an error for "*Santa Cecilia*."

*Sierra de Caballos* (*Caballos Mountains*).—A mountain ridge in the northern part of the main island, east of Nueva Gerona, running north and south, parallel with the Rio Sierra de Casas, and terminating in a headland on the coast known as Punta del Colombo. For a fuller description see page 149.

*Sierra de Casas* (*Casas Mountains*).—A ridge lying west of the town of Nueva Gerona, and about two and one-half miles in length, from north to south. See description on page 149.

*Sierra de la Cañada* (*Cañada Mountains*).—An elevated ridge in the southwestern part of the main island, rising to a height of nine hundred and eighty-five feet (*fide* O. E. Jennings). For a further description see page 149. Visited by both Mr. Read and Mr. Link.



*Siguanea*.—A town-site at the southwestern extremity of the main island. As the name is used by Mr. Link, it covers the coast in the immediate vicinity, and the western end of the Cienaga for a distance of several miles.

*Siguanea Bay*.—See *Ensenada de la Siguanea*.

*Vivijagua*.—See *Bibijagua*.

*West McKinley*.—A name used by the promoting land-company for the tract and settlement on the west side of the Rio de las Nuevas, later on called Santa Barbara, which see. Many of Mr. Read's observations were made here.

#### LIST OF SPECIES.

The order of the present list follows that laid down for the higher groups by Mr. Robert Ridgway in the first volume of his *Birds of North and Middle America*. The actual sequence of the species, however, so far as it has appeared in the body of that work, has been reversed, and in the groups not yet treated by that author arranged as well as may be to correspond. In matters of nomenclature the aim has been to follow the latest and best authorities, save only where the facts seem to justify a different course. While certain of the rulings of the International Commission on Zoölogical Nomenclature, as for example the one which requires the original spelling to be followed in the duplication of the final "i" in patronymic names, are decidedly objectionable to the writer, he proposes to waive his personal prejudices for the sake of uniformity. Such species as in the judgment of the writer are not fully authenticated as birds of the Isle of Pines are included in their proper places, but are printed in smaller type, and without a number prefixed. All measurements are in millimeters, and in every case the length of the bill is that of the exposed culmen. Free use has been made of Mr. Ridgway's *Color Standards and Color Nomenclature* in discussing color variations and preparing descriptions. As regards the names in the reference lists under the several species, it should be explained that variations in orthography or abbreviation do not appear under separate entries, all such having been combined under one head, so long as the intention of the author is clear. The formal citation of vernacular names in this connection is of course defensible, in a faunal paper such as this, on the ground of tending to completeness. The locality names in the references have for the most part been given in corrected form.



1. *Colymbus dominicus dominicus* Linnæus. SAINT DOMINGO GREBE.

"Least Grebe" READ, *Oölogist*, XXVII, 1910, 15, and XXX, 1913, 131 (I. of Pines, Dec. 25, 1909); XXVIII, 1911, 114 (West McKinley).

*Colymbus dominicus* READ, *Oölogist*, XXVIII, 1911, 13 (I. of Pines).

One specimen: Caleta Grande.

This example, the only one observed, was shot in a small lagoon on November 28. It is an adult male in full winter dress, with a white throat. In size it agrees with Cuban specimens, measuring as follows: wing, 96; culmen, 26. Mr. Read has recorded the species in the northwestern part of the island, and writes that he shot a specimen April 14, 1910, along the Nuevas River. It is evidently not a very common bird on the island, and by reason of its secretive habits readily eludes observation.

2. *Podilymbus podiceps* (Linnæus). PIED-BILLED GREBE.

*Podilymbus podiceps* BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 184 (Nueva Gerona, breeding, *vide* Palmer & Riley; Laguna Grande, March).—READ, *Oölogist*, XXVIII, 1911, 11 (I. of Pines).

"Pied-billed Grebe" READ, *Oölogist*, XXVI, 1909, 102 (I. of Pines).—READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines, May 7).—READ, *Oölogist*, XXVIII, 1911, 113 (West McKinley).

One specimen: Los Indios.

Recently Mr. Outram Bangs has described the Pied-billed Grebe of the Antilles as a distinct subspecies, *Podilymbus podiceps antillarum* (*Proceedings New England Zoölogical Club*, IV, 1913, 89). After an examination of the type-specimen and certain other material I find myself unable to indorse this separation on any grounds whatever. The type is no smaller than a female specimen from northern Brevard County, Florida, in the collection of the Carnegie Museum, taken at just about the same date. Females of this species, besides being smaller, seem to have on an average a more restricted black throat-patch than males, and I have reason to believe that the black marking on the side of the bill is a variable character, dependent largely upon season, and not especially correlated with locality. A breeding specimen from Great Inagua, Bahama Islands, is certainly in nowise distinguishable from continental examples. According to Baird, Brewer, & Ridgway (*Water Birds of North America*, II, 1884, 441), South American examples are not tangibly different, contrary to what might be expected in the case of such a wide-ranging species.

There are only a few records for this species for the Isle of Pines, where it is evidently not a common bird. Mr. Link did not meet with it at all, the single example recorded above having been forwarded to the Carnegie Museum by Mr. Frederic F. Baggesen, who secured it at Los Indios on October 16, 1913. Mr. Zappey saw none in 1904, and but two in March, 1902, at Laguna Grande. That the species breeds on the island, however, is attested by Mr. Riley, who says that he found an adult and three downy young of fair size at Santa Rosalia Lagoon, southeast of Nueva Gerona, early in July, 1900. "One of the downy young was secured, but the other two and the adult eluded me, as they could swim and dive faster than I could wade." Mr. Read enters this species on his list as a rare resident.

### 3. *Anhinga anhinga* (Linnæus). WATER TURKEY.

*Anhinga anhinga* CORY, Cat. W. Indian Birds, 1892, 84 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 310 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 185 (Nueva Gerona [*vide* Palmer & Riley] and the Cienaga).—READ, Oölogist, XXVI, 1909, 165 (Nuevas River; habits); XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Dec. 20, 1913 (descr.; habits). "Anhinga" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVIII, 1911, 6, 10 (Nuevas River), 113 (West McKinley); XXX, 1913, 130 (I. of Pines).

Although recorded by almost all the observers who have studied the avifauna of the Isle of Pines, the Anhinga or Water Turkey does not seem to be a very common bird there. Mr. Zappey found it only in the region of the Cienaga, where he says that individuals might be seen almost any day, perched on dead branches of trees. A single adult bird, still retaining some of the lengthened feathers of the crown and nape, was shot by Mr. Link on the Los Indios River on December 18. He saw others also on the Majagua River, and near Siguaná, at the eastern end of the Cienaga. There are, however, numerous records from the northern part of the island as well, to which may be added those of individuals seen near Bibijagua and Santa Ana by Mr. Link. Mr. Read has given us an entertaining account of the fishing habits of this species as observed by him on the Nuevas River. The natives consider the flesh of this bird very palatable.

### 4. *Phalacrocorax auritus floridanus* (Audubon). FLORIDA CORMORANT.

*Phalacrocorax floridanus* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—GUNDLACH, Orn. Cubana, 1895, 305 (I. of Pines).

*Phalacrocorax dilophus floridanus* CORY, Cat. W. Indian Birds, 1892, 85 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 185 (I. of Pines, coastwise).—(?) READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Apr. 25, 1914 (Bird I., Siguanea Bay).

"Florida Cormorant" (?) READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, Dec. 6).—(?) READ, Oölogist, XXVI, 1909, 58 (I. of Pines); (?) XXVIII, 1911, 10 (Nuevas River, May 17), 146 (Morrillo del Diablo); XXX, 1913, 123 (north coast, off Nuevas River), (?) 125 (Santa Barbara), (?) 130 (I. of Pines), (?) 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).

Nine specimens: Los Indios.

Only two of these are adults in full black glossy plumage, neither of which, however, although taken in the breeding season, show any sign whatever of lateral crests. One specimen is abnormal in possessing *fourteen* rectrices.

Cormorants of this species are common all along the coast and about the outlying cays; in fact, it is in such situations one of the most abundant and characteristic water-birds. It breeds in colonies at certain points, the nests being built in the mangroves at a low elevation, and composed merely of a few sticks. Two eggs are the usual complement; they are dull bluish green in color, with rough, chalky shells. The species seems to have an extended breeding season, eggs and downy young having been found at a colony in Bird Island, in Siguanea Bay, at such widely separated dates as October 18 and April 16. At another colony, in a lagoon south of Los Indios, eggs were secured on October 7, and a month later downy young, possibly two weeks old. The island of Morrillo del Diablo, on the north coast, off Punta del Colombo, is another favorite resort of this species. Although partial to the salt water, individuals occasionally ascend the rivers for a little distance, one having been shot on January 21 on the Los Indios River, three miles from its mouth.

It is possible that some of Mr. Read's records above quoted may refer to the following species.

5. *Phalacrocorax vigua mexicanus* (Brandt). MEXICAN CORMORANT.

*Phalacrocorax vigua mexicana* (sic) BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 185 (Pasadita, May; meas.; crit.).

One specimen: Bibijagua.

The only one observed by Mr. Link was shot near the coast at Bibijagua on July 4. Mr. Zappey secured a specimen at Pasadita in May. These two occurrences are at present the only certain records

for the island, where it evidently is not common. Unlike *P. auritus floridanus*, it is wont to frequent fresh as well as salt water. Specimens are indistinguishable from typical examples from Mexico. Its distribution in the West Indies is apparently restricted to Cuba, the Isle of Pines, and Watlings Island of the Bahaman group.

6. *Pelecanus occidentalis* Linnæus. BROWN PELICAN.

*Pelecanus fuscus* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 85 (I. of Pines, in geog. distr.).

—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 185 ("south coast").

"Brown Pelican" READ, Oölogist, XXVIII, 1911, 10 (Nuevas River), 13 (I. of Pines); XXX, 1913, 131 ("south coast").

*Pelecanus occidentalis* READ, I. of Pines News, VI, Apr. 25, 1914 (Caleta Grande).

Six specimens: Caleta Grande.

Four different plumages are represented. There are two in juvenal dress (November 26), with white under parts and grayish heads and necks. Two others taken at the same time are obviously immature, showing the neck-pattern of the adult in brownish gray instead of chestnut, the under parts, however, being dark-colored. The series available for study being insufficient to illustrate the sequence of plumages in this species, I am a little uncertain as to the exact age of these two examples, but believe them to be in first nuptial dress, assuming that the species breeds in the second year, or, if it does not, in a plumage which corresponds to this in time. Both of these specimens show fresh gray feathers mixed with the worn brown ones characteristic of the juvenal plumage, the moult affecting the rectrices also. There are two spring specimens (April 18 and 23), one of which has the back of the neck chestnut, while in the other the head and neck all around are white. This latter corresponds to the description of the adult in winter plumage, and compares favorably with non-breeding specimens from Costa Rica and Colombia. Mr. Ogilvie-Grant (*Catalogue Birds British Museum*, XXVI, 1898, 478), however, says that "nearly mature" birds "do not assume the dark velvety-brown neck in the breeding-season, these parts remaining white like those of the adult in winter-plumage." But, if I am correct as to the stage of plumage represented by the immature birds described above, it would be strange indeed to find them assuming the pattern of the adult for the first breeding-season, only to lose it for the second. It is well known that this species has an extensive breeding-season, nesting along the Cuban coast, according to Gundlach, from June to

September, while on Pelican Island, Florida, two broods are said to be raised, one in May and one in September. The difference in the time of nesting would readily account for the presence of birds in winter or non-breeding plumage at the same season as those in full nuptial dress.

Although the Brown Pelican has been occasionally noted in the northern part of the Isle of Pines, it is far more numerous about the "south coast." Mr. Link found it to be very common at Caleta Grande on November 26 and 27, and again in April, fishing in the shallow water. Individuals were noted also at Cabo Frances, Los Indios, the Majagua River, and at Punta del Este, at the southeastern corner of the island. It is evident that the breeding-place of these birds must be somewhere along this coast, but it was not discovered, nor did any of the natives seem to be aware of its location. Probably it is in some retired inlet or lagoon, or perhaps on one of the isolated cays not yet visited by any ornithologist.

**7. *Pelecanus erythrorhynchos* Gmelin. WHITE PELICAN.**

*Pelecanus erythrorhynchus* CORY, Cat. W. Indian Birds, 1892, 85 (I. of Pines, in geog. distr.), 136 (I. of Pines, *ex* —?).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 185 (I. of Pines, *ex* Cory).

The claim of the White Pelican to a place in the present list rests solely on the authority of Mr. Cory, as above. I have been unable to discover upon what grounds his record is based. There is but one authentic record for Cuba, and if it occurs in the Isle of Pines at all it can only be as a very rare and irregular winter visitor.

**8. *Fregata magnificens* Matthews. MAN-O'-WAR-BIRD.**

*Fregata aquila* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *fide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 85 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 185 (Manigua, *fide* Palmer & Riley, Santa Fé, and "south coast").

"Frigate Bird" READ, Oölogist, XXVIII, 1911, 13, and XXX, 1913, 130 (I. of Pines).—READ, I. of Pines News, VI, Apr. 25, 1914 (Sigüanea Bay).

Fifteen specimens: Bird Island.

This species, although apt to be seen flying over on occasion almost anywhere in the island, inland as well as coastwise, is not known to breed locally, except on a small mangrove cay near the head of Sigüanea Bay, known as Bird Island. Here a colony of several hundred individuals is established, occupying an extensive area on the south side of the island, while the Florida Cormorants are confined to another



part. This colony was first visited on October 18 and 19. The adult birds proved to be rather shy on this occasion, but a series of young in juvenal plumage was secured, some still showing remains of the natal down in places. Although practically fully grown, some of the young birds were still confined to the nest, and could only be forced to leave by the use of considerable persuasion. Numerous dead young were noticed, caught by the neck in the fork of a branch, where they had fallen out of the nests, which are so small and frail that one wonders how the young contrive to remain in them at all. Should they drop into the water below they at once fall victims to the waiting crocodiles. A second visit to this same spot, made on April 16 and 17, found the birds with eggs and downy young, some of which were secured, as well as a series of adults. Both sexes incubate, and the brooding birds are very loath to leave their eggs or young. The half of the birds off duty at any given time are wont to keep swinging about overhead in graceful circles, when not actually engaged in fishing.

9. *Botaurus lentiginosus* (Montagu). BITTERN.

*Botaurus lentiginosus* CORY, Cat. W. Indian Birds, 1892, 89 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 192 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (I. of Pines, *ex* Cory and Gundlach).—COOKE, Bull. Biol. Survey, No. 45, 1913, 26 (I. of Pines, *ex* Gundlach).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines [*ex* Cory and Gundlach]).

A winter visitant, apparently rare, the only records being the indefinite ones cited above, which doubtless all rest on the authority of Gundlach. The species has been recorded as a casual or accidental visitant to Jamaica and Porto Rico, and according to Gundlach is not rare in western Cuba, so that further records from the Isle of Pines may be anticipated.

10. *Ixobrychus exilis exilis* (Gmelin). LEAST BITTERN.

*Ardetta exilis* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (Cienaga).

"Least Bittern" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58, and XXVII, 1910, 15, and XXVIII, 1911, 7 (I. of Pines); XXVII, 1910, 5 (Nuevas River); XXVIII, 1911, 113 (West McKinley).

*Ixobrychus exilis* READ, Oölogist, XXVIII, 1911, 11, and XXX, 1913, 132 (I. of Pines).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines).—READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

One specimen: Siguanea.

April 28 is the date of capture, which at least raises a strong presumption of this being a breeding bird, contrary to what Messrs. Bangs and

Zappey indicate. The specimen, an adult male, is rather smaller than the average (wing, 110 mm.), although it is in fresh plumage; its posterior under parts are much whiter, in fact, pure white medially down to the under tail-coverts. Examination of a considerable series of this species, however, shows that such pale birds are not localized in their distribution, but occur at such widely separated points as Sacramento, California (No. 33,353, Collection Museum Comparative Zoölogy), Fort Snelling, Minnesota (No. 189,493, Collection U. S. National Museum), and Lake Harney, Florida (No. 152,913, Collection U. S. National Museum), so that they can have no geographical significance. One other individual was seen by Mr. Link, at Los Indios early in October, while Mr. Read sets it down in his list as a common winter resident. In a letter from Mr. Charles T. Ramsden, of Guantánamo, Cuba, he expresses the opinion that it would be very difficult to distinguish breeding examples from winter-resident birds (if, indeed, the northern birds come to Cuba at all), for the reason that he has found partly incubated eggs on December 10, while it is improbable that a specimen shot May 10 was other than a breeding bird. Mr. Zappey found the Least Bittern common in the Cienaga in March, 1902. Jamaica seems to be its southern breeding limit in the Antilles.

## II. *Ardea occidentalis repens* Bangs and Zappey. CUBAN GREAT WHITE HERON.

*Ardea repens* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 186 (Cienaga and cays off coast; orig. descr.; type now in coll. Mus. Comp. Zoöl.).—ALLEN, Auk, XXII, 1905, 329, in text (review).—EDITORS, Ibis, 1905, 631, in text (review).—READ, Oölogist, XXVIII, 1911, 11, and XXX, 1913, 132 (I. of Pines, rare).—

READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines, rare; descr.).

"Great White Heron" READ, Oölogist, XXVI, 1909, 75 (I. of Pines).—READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, Mar. 13).

"Cuban White Heron" READ, Oölogist, XXVII, 1910, 5, and XXVIII, 1911, 10 (Nuevas River), 146 (Bibijagua); XXX, 1913, 123 (Pine River), 125 (Santa Barbara), 131 (I. of Pines, Mar. 13).

*Ardea herodias repens* BANGS, Auk, XXXII, 1915, 484, part (I. of Pines; crit.).

One specimen: El Bobo Lagoon.

### MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus.
13241 <sup>1</sup>	♀	Cienaga, I. of Pines . . . . .	440	156	144	172
41205 <sup>2</sup>	♀	El Bobo Lagoon, I. of Pines . . . . .	413	152	121	154

<sup>1</sup> Collection E. A. and O. Bangs. Type.

<sup>2</sup> Collection Carnegie Museum.

The measurements of this, the second specimen of this rare bird recorded from the Isle of Pines, show that it is smaller than the type. Although apparently fully grown, it is certainly immature, as indicated by the shreds of downy filaments still adhering to some of the feathers of the occiput, and by the dark-colored upper mandible. The type-specimen, which has been examined in this connection, also looks like an immature, or at least a non-breeding bird, having a dark upper mandible, and lacking any trace of occipital, scapular, and jugular plumes. It is of course to be expected that fully adult males in breeding dress would average somewhat larger, and resemble the Florida bird in their ornamentation. The smaller size being apparently the only character separating it from the latter, I prefer to let it stand as a subspecies. My views regarding the specific distinctness of *Ardea occidentalis* coincide with those of Mr. Oberholser (*Proceedings United States National Museum*, XLIII, 1912, 541), but it may be worth while to point out that in the matter of size *A. occidentalis occidentalis* bears exactly the same relation to *A. occidentalis repens* as does *A. herodias wardi* to its West Indian representative, *A. herodias adoxa*—a circumstance which may or may not be significant.<sup>3</sup> Additional specimens of the present form are naturally very desirable. The iris in the specimen taken by Mr. Link is marked as "straw-color."

This heron is rather rare throughout the island, and very shy and difficult to approach. It is found mostly in the open marshy country, where there is not enough cover to conceal the movements of the hunter. The individual secured was surprised near El Bobo Lagoon, northeast of McKinley, on March 7. Another was repeatedly observed in October and November along the Majagua River, but eluded all efforts to approach it within gunshot. Towards the western end of the Cienaga as many as three were observed together on one occasion (November 14). One was noted flying overhead near Nueva Gerona. Although it may readily be distinguished in life from the Egret by its superior size, it is possible that some of Mr. Read's records above quoted may refer to the latter species. Messrs. Palmer and Riley

<sup>3</sup> This was written before the appearance of Mr. Bangs's recent paper (*Auk*, XXXII, 1915, 481-484), in which he contends that *Ardea occidentalis* is merely a white phase of *Ardea herodias wardi*. Although he presents no new evidence bearing on the case, it must be admitted that the presumption in favor of his view is by no means weak, reasoning by analogy. But it would seem to be a matter which can be settled only by further and detailed observations in the field.

saw a few about the cays, and it is probable that the species breeds on some of the more retired of these islands.

**12. *Ardea herodias adoxa* Oberholser. WEST INDIAN BLUE HERON.**

*Ardea herodias* (not of Linnæus) POEY, Mem. Hist. Nat. Cuba, 1851, 427 (Nueva Gerona, *fide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 89 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat. XXXIX, 1905, 186 (cays off coast and the Cienaga; crit.).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines, not common; descr.).—READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

"Ward's Heron" (error) READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 102, and XXX, 1913, 130 (I. of Pines, rare); XXVIII, 1911, 10 (Nuevas River), 113 (West McKinley, rare); XXX, 1913, 123 (Pine River).

*Ardea herodias adoxa* OBERHOLSER, Proc. U. S. Nat. Mus., XLIII, 1912, 544 (I. of Pines, in geog. distr.).—COOKE, Bull. Biol. Survey, No. 45, 1913, 37 (I. of Pines; crit.).

"Great Blue Heron" READ, Oölogist, XXX, 1913, 125 (Santa Barbara), 168 (Los Indios).—READ, I. of Pines News, VI, Apr. 25, 1914 (Pine River).

*Ardea herodias wardi*? READ, Oölogist, XXVIII, 1911, 11 (I. of Pines); XXX, 1913, 132 (Nuevas River).

*Ardea herodias repens* (not of Bangs and Zappey?) BANGS, Auk, XXXII, 1915, 484, part (I. of Pines; crit.).

One specimen: Los Indios.

This bird, shot November 23, is in immature dress, with much more rufescent suffusion below than in any of the specimens of *A. h. herodias* and *A. h. wardi* of the same age available for comparison, although no especial difference in the color of the upper parts is observable. The middle wing-coverts are old and worn, while the greater and most of the lesser series are fresh. Without additional material I do not attempt to discuss the claims of this particular form to recognition, further than to state that it certainly cannot be confused with *A. h. wardi*.

Great Blue Herons are rather common throughout the island, and were noted at almost all the localities visited by Mr. Link, wherever there was water. They unquestionably breed on certain of the outlying cays, whence young in the downy stage brought back by fishermen were examined. No nests were discovered on the mainland, although there is no reason why the birds should not breed there upon occasion. Mr. Read has also observed them frequently in the course of his peregrinations in the northern part of the island, but his identification of the individuals seen as belonging to the Florida form is obviously in error. He writes that he took but one specimen, which he shot at Pine River on July 12, 1911.

**13. *Herodias egretta* (Gmelin). EGRET.**

*Ardea egretta* CORY, Cat. W. Indian Birds, 1892, 89 (I. of Pines, in geog. distr.).  
*Herodias egretta* GUNDLACH, Orn. Cubana, 1895, 181 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 186 (I. of Pines, inland and coastwise; Nueva Gerona, *vide* Palmer & Riley; La Vega; formerly abundant).—READ, Oölogist, XXVIII, 1911, 11, and XXX, 1913, 132 (I. of Pines).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines, rare; descr.).  
 "American Egret" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 124, and XXX, 1913, 131 (I. of Pines).

Three specimens: Pasadita.

Only one of these (No. 41,405, May 28) is in (worn) breeding dress. The other two, shot on May 23, may also be adults, but they show no signs of dorsal plumes.

On the Isle of Pines, as elsewhere throughout its range, the Egret has suffered sadly from the persecution of the plume-hunters, until its numbers are now but a fraction of what they formerly were. The few birds which remain, although protected by law, are shot at by the natives surreptitiously at every opportunity, until they have become so shy that it is now only by chance that they can be approached at all. As many as seven together were seen on one occasion at a lagoon east of the mouth of the Nuevas River, but they easily eluded the efforts of four gunners to get within range. It is not known precisely where the local breeding-grounds of this species are at the present time. Mr. Zappey speaks of seeing Egrets on the coast as well as inland, but Mr. Link did not observe any except about fresh water.

**14. *Dichromanassa rufescens* (Gmelin). REDDISH EGRET.**

*Ardea rufescens* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

A single individual of this species was identified by Mr. Link in a salt-water marsh at Los Indios on October 7, but eluded capture. Poey's record above quoted seems to be the only other known instance of its occurrence on the island.

**15. *Florida cærulea* (Linnæus). LITTLE BLUE HERON.**

*Ardea cærulea* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 90 (I. of Pines, in geog. distr.).

*Florida cærulea* GUNDLACH, Orn. Cubana, 1895, 186 (I. of Pines).

"Little Blue Heron" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 75, and XXX, 1913, 130 (I. of Pines, common); XXVII, 1910, 5, and XXVIII, 1911, 6, 10, and XXX, 1913, 123 (Nuevas River); XXVIII, 1911, 113 (West McKinley), 146 (Bibijagua); XXX, 1913, 125, 127 (Santa Barbara).



*Florida carulea carulescens* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 187 (Guanabana, the Cienaga, and seacoast, common).—READ, Oölogist, XXVIII, 1911, 11, and XXX, 1913, 132 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines; descr.).

Eleven specimens: Los Indios and Majagua River.

The series comprises seven white and four blue birds, but only one of the latter is without any scattering white feathers. These blue individuals, together with another from Porto Rico, are quite indistinguishable from Florida examples, so far as I can see. Mr. Riley (*Smithsonian Miscellaneous Collections*, Quarterly Issue, XLVII, 1904, 279) has adopted the name *carulescens* of Latham, based on birds from Cayenne, as the subspecific appellation of the Little Blue Herons of the Greater and Lesser Antilles and of Central and South America, alleging that they are much darker than those of Florida and farther north. I have not seen any Cayenne examples, but can find no characters to distinguish Colombian birds, while the series of Florida specimens studied certainly shows a considerable degree of individual variation in depth of coloration. But as such variation in the West Indian birds is fully as great, there is no reason for thinking that it has any geographical significance.

All observers agree that the Little Blue Heron is the commonest species of its tribe in the island, both on the coast, cays, and in the inland districts, wherever there is water. It is particularly numerous in the Cienaga, however, and is also partial to the brackish lagoons along the coast. According to Mr. Link's experience, the blue and white phases are about equally common at all seasons. He found several nests in process of construction early in May, all in the mangroves along the Los Indios River. Except in the breeding-season, the species was frequently observed in small parties, wading about on the edges of lagoons, the margins of rivers, and the open marshes. Not being persecuted as are some of the other herons, it is as a rule not nearly so shy.

#### 16. *Egretta thula thula* (Molina). SNOWY EGRET.

*Leucophoyx candidissima* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 187 (Jucaro and the Cienaga).

"Snowy Heron" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58, and XXX, 1913, 130 (I. of Pines); XXVIII, 1911, 6 (Nuevas River), 113 (West McKinley); XXX, 1913, 125, 127 (Santa Barbara), 164 (Santa Barbara to Nueva Gerona).

*Herodias candidissima* READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).

*Egretta candidissima* READ, Oölogist, XXX, 1913, 132 (I. of Pines).

*Ardea candidissima* READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines; descr.).

Messrs. Bangs and Zappey state that "the Snowy Heron is now very rare on the Isle of Pines, having been killed off for its plumes. One was seen in the Cienaga, and at Jucaro a native had a wounded bird that was kept alive in confinement." Aside from this, the only records are those by Mr. Read, above quoted. He writes that he took a specimen December 1, 1909, on the Nuevas River, and that he has since seen several along this same stream. But the possibility of confusing this species with the white phase of the Little Blue Heron is so great that it is very doubtful if it occurs as frequently as a perusal of Mr. Read's notes would lead us to believe. Mr. Link, indeed, made a special search for this species, going in pursuit of every small white heron that he saw, but all turned out to be Little Blue Herons in the white phase.

#### 17. *Hydranassa tricolor ruficollis* (Gosse). LOUISIANA HERON.

*Ardea leucogaster* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *fide* Gundlach).

*Ardea tricolor ruficollis* CORY, Cat. W. Indian Birds, 1892, 89 (I. of Pines, in geog. distr.).

*Hydranassa tricolor ruficollis* GUNDLACH, Orn. Cubana, 1895, 183 (I. of Pines).—

BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 187 (seacoast, Cienaga, etc.).—

HELLMAYR, Nov. Zoöl., XIII, 1906, 50 (I. of Pines; meas.).—READ, Oölogist, XXVIII, 1911, 11, and XXX, 1913, 132 (I. of Pines).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines; descr.).

"Louisiana Heron" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 102, and XXX, 1913, 130 (I. of Pines); XXVIII, 1911, 10 (Nuevas River), 113 (West McKinley); XXX, 1913, 125 (Santa Barbara).

*Hydranassa tricolor* (not of Müller) READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

Four specimens: Los Indios and Bird Island.

Two of the Los Indios examples, dated October 1 and 4 respectively, are in worn breeding dress, while a third, taken May 8, is in full nuptial plumage. The specimen from Bird Island, shot on October 18, is in juvenal plumage, the neck and breast being deep rufous, and the pileum, hind neck, and flanks still bearing remains of the natal down. All of these specimens have rather more rufous on the throat than the average Florida bird, possibly indicating divergence in the direction of the subspecies *rufimentum*, described from Trinidad by Mr. Hellmayr.

Although not so common in the Isle of Pines as the Little Blue Heron, this bird is still fairly numerous. It is seldom found away from the salt and brackish waters of the coastal lagoons and the lower courses of the rivers, where it may often be found in company with the Little Blue Heron. Mr. Zappey secured a single specimen in the Cienaga, but the species was observed there by Mr. Link only at its western end, near Sigüanea. No nests were found, but it probably breeds in May, as does the Little Blue Heron.

18. ***Butorides virescens cubanus*** Oberholser. CUBAN GREEN HERON.

*Ardea virescens* (not of Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Butorides virescens maculata* (not of Boddaert) BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (Bibijagua and Santa Fé; crit.).—THAYER & BANGS, Bull. Mus. Comp. Zool., XLVI, 1905, 142 (Bibijagua and Santa Fé; meas.; crit.).—READ, Bird-Lore, XIII, 1911, 44 (McKinley).—READ, Oölogist, XXVIII, 1911, 11, and XXX, 1913, 132 (I. of Pines).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines, common; descr.).

"Green Heron" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVIII, 1911, 146 (Bibijagua); XXX, 1913, 123 (Nuevas River).

"Southern Green Heron" READ, Oölogist, XXVII, 1910, 5, and XXVIII, 1911, 6, 10 (Nuevas River), 3 (McKinley), 113 (West McKinley); XXX, 1913, 127 (Santa Barbara), 130 (I. of Pines).

"Little Green Heron" READ, Oölogist, XXVIII, 1911, 5 (Santa Barbara Mountain, etc.).

*Butorides virescens cubanus* OBERHOLSER, Proc. U. S. Nat. Mus., XLII, 1912, 557 (Santa Fé, Bibijagua, and Nueva Gerona; meas.; crit.).

*Butorides virescens brunescens* (not *Ardea brunescens* Lembeye ?) BANGS, Auk, XXXII, 1915, 484, part (I. of Pines; crit.).

Six specimens: Los Indios, Nueva Gerona, Jacksonville, and Sigüanea.

MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus.
41271 <sup>4</sup>	♀	Jacksonville, I. of Pines.....	166	61	64	48
41308 <sup>4</sup>	♂	Sigüanea, I. of Pines.....	165	61	64	47
39054 <sup>4</sup>	♂	Guayama, Porto Rico.....	179	61	58	53
39205 <sup>4</sup>	♂	Adjuntas, Porto Rico.....	175	64	54	47
39305 <sup>4</sup>	♀	Utuado, Porto Rico.....	164	58	56	45
28693 <sup>5</sup>	(♂?)	Martinique.....	181	70	61	49
28694 <sup>5</sup>	(♂?)	Martinique.....	179	64	56	53
Eight adult males from eastern U. S., average.....			179	65	61	51

<sup>4</sup> Collection Carnegie Museum.

<sup>5</sup> Collection Museum Comparative Zoölogy.

Only two of the above are fully mature; the others all show more or less brownish suffusion on the posterior under parts, a condition very well marked in No. 39,932 (Nueva Gerona, December 31), which approaches *B. brunescens* very closely in this respect, and is moreover entirely purplish brown above.

The two adults, together with a few examples from other localities, included for comparison, measure as shown in table on page 182.

In discussing the relationships of the Bahaman form of *Butorides virescens* not long since (ANNALS CARNEGIE MUSEUM, VII, 1911, 410), I ventured the opinion that the West Indian bird was scarcely or not at all separable from the typical form. More recently, since the receipt of the specimens above recorded, I have been led to look into the question anew, in the light of the rather startling conclusions reached by Mr. Oberholser in his late revision of the races of this species (*Proceedings U. S. National Museum*, XLII, 1912, 529-577). It is not my purpose at this time to critically review the paper in question, lacking as I do sufficient material to serve as a basis for a full discussion, but merely to call attention to several points suggested by the study and comparison of these specimens. Mr. Riley (*Smithsonian Miscellaneous Collections*, Quarterly Issue, XLVII, 1904, 278) was apparently the first to note the somewhat smaller size and slightly different coloration of the Green Heron of the West Indies, for which he adopted the subspecific name *maculata* Boddaert. Later Mr. Clark (*Proceedings Boston Society of Natural History*, XXXII, 1905, 234) and Messrs. Thayer and Bangs (*Bulletin Museum Comparative Zoölogy*, XLVI, 1905, 143) confirmed Mr. Riley's observations as to the smaller size from independent investigation. Mr. Oberholser now proposes to split up the birds from the Greater and Lesser Antilles into no less than *eight* different races, based on slight variations in color and relative proportions, the only alternative (so he claims) being to merge all the West Indian birds, including even those from the Bahama Islands, with true *virescens*. Our present concern is with the bird of the Isle of Pines, which, together with those of Haiti and Porto Rico, Mr. Oberholser refers to the Cuban form, which he calls *cubanus*. This is described as smaller than true *virescens*, with the neck and sides of the head usually lighter, more rufescent, less purplish, and the abdomen also averaging paler. From *maculatus*, which name is restricted to the bird of Martinique, it is said to differ in its smaller size (except the bill), and in its darker, less purplish neck



and sides of head. The natural inference would be, therefore, that *maculatus* and *virescens* approximate each other in their characters! Through the courtesy of Mr. Bangs I have before me the two adult specimens from Martinique upon which Mr. Oberholser has based his comparisons. They prove to be very poor skins, with necks unduly stretched—a feature which makes the colors of the feathers of this part appear less intense. The measurements (which I have confirmed), it will be noted, are fully up to those of true *virescens*, and, although the neck and sides of the head are slightly paler, it is true, than the average specimen of that form, it is easy to match their colors in a series. Even on the assumption that additional material from Martinique would bear out the trifling differences indicated, formal separation would seem scarcely justifiable. Admitting that Green Herons from the West Indies (collectively considered) average slightly smaller and paler than those from eastern North America, and are thus possibly worthy of subspecific recognition, it is confusing to find the only specimens from the type-locality of *maculatus*, the earliest name available for the birds of this region, differing so little. Two male examples from Porto Rico, also, are larger, instead of smaller, than the average. In short, the variation in size seems so great, on the whole, and the range in color so subtle and inconstant in character, even in specimens from the same locality, that it is only provisionally, and with great reluctance, that I here recognize the Cuban and Porto Rican bird as distinct subspecifically. In any case, it is certainly far less trenchantly defined than the Bahaman race, contrary to Mr. Oberholser's implication. After a study of his paper it is difficult to avoid the impression that he has carried subdivision too far. Surely the use of trinomials, for which the American school of ornithologists has contended so long, was never designed to cover such a case as this. Even admitting that this is largely a matter of individual opinion, it would nevertheless seem true as a general proposition that a certain amount of variation ought to be allowed a given species without thereby subjecting it to formal division. There are limits in refinement beyond which it does not seem profitable to go, and while, as previously remarked, I am not now in a position to go into further details in this particular case, I suspect that the acquisition of fresh material may eventually necessitate a revision of present conclusions.<sup>6</sup>

<sup>6</sup> In this connection I may add that Dr. Thomas Barbour has advised me that it is absolutely certain, from repeated and extensive observations, that neither the



The Cuban Green Heron is one of the most abundant of its tribe in the Isle of Pines, where it prefers the fresh or brackish water of the rivers or lagoons to the seacoast. In its habits it is not especially different from the bird of the United States. Messrs. Palmer and Riley found a nest near Nueva Gerona on July 8, containing two eggs on the point of hatching. Nests in process of construction, believed to belong to this species, were found by Mr. Link at Los Indios and Sigüanea in March and April, built in the mangroves over the water.

19. ***Butorides brunescens*** (Lembeye). CUBAN BROWN HERON.

*Butorides brunescens* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (Nueva Gerona, *vide* Palmer and Riley).—OBERHOLSER, Proc. Biol. Soc. Washington, XXV, 1912, 53 (Nueva Gerona; descr.; crit.).—COOKE, Bull. Biol. Survey, No. 45, 1913, 60 (I. of Pines, in geog. distr.).—READ, Oölogist, XXX, 1913, 131 (I. of Pines), 132 (West Coast Section, *i. e.*, Santa Barbara).—READ, I. of Pines News, VI, Dec. 27, 1913 (Los Indios and west coast, fairly common; rare in interior; descr.).—READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

"Cuban Green Heron" READ, Oölogist, XXVIII, 1911, 13 (I. of Pines), 114 (West McKinley); XXX, 1913, 123 (Pine River), 125, 127 (Santa Barbara).

*Butorides virescens brunescens* BANGS, Auk, XXXII, 1915, 484, part (I. of Pines; crit.).

Five specimens: Los Indios and Nueva Gerona.

Two of these are adult males (October 9 and 28), one with many of the scapular plumes glaucous gray, while in the other they are almost entirely bottle-green. The other three specimens are young birds in various stages of the postjuvénal moult, which involves only the body-plumage and wing-coverts. In two specimens shot September 30 this moult is just beginning, but in a third, taken February 1, it is far advanced. The iris is marked as "light yellow."

For a full account of this species the paper by Mr. Oberholser, above quoted, should be consulted. While I agree with his conclusions as to the status of this form it may be well to call attention again to the brown-bellied specimen of *Butorides virescens cubanus* noted under the head of that species, and which suggests an approach to the present form.

Described originally from Cuba, where it was said by Gundlach to be very rare, it has long been suspected to be merely a color-phase

Green Heron nor any other heron breeds on Swan Island, in the Caribbean Sea, the few individuals which have been observed there being unquestionably migrants, remaining for but a few days at a time. This circumstance of course disposes definitely of *Butorides virescens saturatus* as a resident form peculiar to the island in question.

of the Green Heron of that island, and as very little seems to have been put on record concerning its habits, and as so few specimens have found their way into collections, its true status has been open to considerable doubt, the more so as dichromatism in this family is of such frequent occurrence. Two specimens were taken by Messrs. Palmer and Riley near Nueva Gerona, and after comparing these and a few others from Cuba with examples of the various forms of *Butorides virescens*, Mr. Oberholser is satisfied that they are specifically distinct. Quite recently, however, Mr. Bangs, in a paper to which the reader is referred above, re-asserts his views to the contrary, putting forth some new and interesting evidence on the point at issue.

So far at least as the Isle of Pines is concerned, the present species is far from being the rare bird it has hitherto been supposed to be. Mr. Read has noted what he believes to have been this form on several occasions, and Mr. Link found it not uncommon at Los Indios. Its favorite haunts were in the mangroves along the seacoast, where it contrived to keep well concealed, slipping through the roots when disturbed in the manner of the Clapper Rail, instead of seeking to escape by flight, as does the Cuban Green Heron under similar circumstances. Its alarm-note or "squawk," too, is so different from that of the other species as to be unmistakable. All of these points in its life-history are interesting, tending to confirm its claim to specific distinctness.

20. *Nycticorax nycticorax nævius* (Boddaert). BLACK-CROWNED NIGHT HERON.

*Nycticorax vulgaris* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *fide* Gundlach).

*Nycticorax nycticorax nævius* CORY, Cat. W. Indian Birds, 1892, 90 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (Bibijagua; Poey's record).—READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines; descr.).—READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

*Nycticorax nævius* GUNDLACH, Orn. Cubana, 1895, 193 (I. of Pines).

"Black-crowned Night Heron" READ, Oölogist, XXX, 1913, 123 (Pine River), 125 (Santa Barbara), 131 (I. of Pines), 168 (Los Indios).

One specimen: Los Indios.

This species is apparently not nearly so common as the Yellow-crowned Night Heron in the Isle of Pines. Although recorded by both Poey, Cory, and Gundlach, it seems to have been noted but infrequently by Mr. Read, while Mr. Link secured only one specimen, a

young bird, much tinged with rusty on the upper parts and wing-coverts, shot at Los Indios on October 2. However, he found it rather numerous, but for some reason very shy, in the Cienaga near Siguanea in November and April. Mr. Zappey saw a flock at a fresh-water lagoon in the northern part of the island in March, 1902, and two others at Bibijagua. Nothing is known at present regarding its breeding haunts in the island.

**21. *Nyctanassa violacea* (Linnæus). YELLOW-CROWNED NIGHT HERON.**

*Nycticorax violaceus* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 90 (I. of Pines, in geog. distr.).—

READ, I. of Pines News, VI, Dec. 27, 1913 (I. of Pines; descr.).

*Nyctherodius violaceus* GUNDLACH, Orn. Cubana, 1895, 194 (I. of Pines).

*Nyctanassa violacea* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (I. of Pines, *ex* Poey, Cory, and Gundlach).—READ, Oölogist, XXX, 1913, 132 ("south coast").

"Yellow-throated [*sic*] Night Heron" READ, Oölogist, XXVIII, 1911, 6 (Nuevas River).

"Yellow-crowned Night Heron" READ, Oölogist, XXVIII, 1911, 13, and XXX, 1913, 131 (I. of Pines), 123 (Pine River), 125 (Santa Barbara).

Six specimens: Los Indios, Majagua River, and Caleta Grande.

All but two of this series are in juvenal dress, and even these two are not fully mature, as shown by the brownish feathers of the pileum and the dusky tinge of the back. These were secured in late October and early November. The individual from Caleta Grande, although otherwise in immature dress, is acquiring the long white occipital plumes. The series of this species examined shows much variation, which, however, is quite independent of locality. Needless to add, I can see no ground for assuming a color-change in the feathers themselves to account for any of this variation, as suggested by Baird, Brewer, & Ridgway (*Water Birds of North America*, I, 1884, 63).

In addition to the localities above quoted, Mr. Link saw this species at Bibijagua on the north coast, while at the western end of the Cienaga, near Siguanea, it was quite common (but very shy) in November, occurring sometimes singly, but more often in small parties, about the edges of the marsh or in the mangroves. Nothing was learned concerning its breeding haunts or habits.

22. *Ajaia ajaja* (Linnæus). ROSEATE SPOONBILL.

*Platalea ajaja* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—GUNDLACH, Orn. Cubana, 1895, 195 (I. of Pines).

*Ajaia ajaja* CORY, Cat. W. Indian Birds, 1892, 88 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 189 (I. of Pines; Poey's record).—COOKE, Bull. Biol. Survey, No. 45, 1913, 12 (I. of Pines, *ex* Poey).

"Roseate Spoonbill" READ, Oölogist, XXX, 1913, 130 (I. of Pines, *vide* G. A. Link).

One specimen: Los Indios.

Mr. Link was so fortunate as to secure a fine adult of this species, shot in the swampy country near Los Indios, October 3, 1912. Within a few days of this date a few others were seen in the vicinity, all very shy, however. Poey recorded the species many years ago, but the supposition was that it had been extirpated, so that the present record becomes of more than usual interest. The natives say that it breeds in the island, which seems not unlikely.

23. *Guara alba* (Linnæus). WHITE IBIS.

*Ibis alba* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach). *Guara alba* CORY, Cat. W. Indian Birds, 1892, 88 (I. of Pines, in geog. distr.).—

GUNDLACH, Orn. Cubana, 1895, 199 (I. of Pines).—COOKE, Bull. Biol. Survey, No. 45, 1913, 14 (I. of Pines, *ex* Bangs and Zappey).

*Eudocimus albus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 188 (Pasadita and the Cienaga; habits).

"White Ibis" READ, Oölogist, XXVIII, 1911, 6, 10, and XXX, 1913, 123 (Nuevas River); XXVIII, 1911, 13, and XXX, 1913, 130 (I. of Pines), 125 (Santa Barbara), 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).

Twelve specimens: Los Indios, Bibijagua, and Siguanea.

According to Baird, Brewer, & Ridgway (*Water Birds of North America*, I, 1884, 90), this species exhibits a range of individual variation in size not exceeded by that in any member of the family. The examination of a series of carefully sexed specimens from various sections shows that this difference is not individual, but sexual, males being decidedly larger than females, the bill especially. Audubon (*Ornithological Biography*, III, 1835, 176) remarks that the male has *five* outer primaries tipped with black, while the female has but *four* thus marked, these figures holding good with but four exceptions in a series of one hundred individuals examined (the exceptions being very old females, which were like the males). Not one of the specimens before me, however, shows more than four primaries with dark tips, while two specimens, both females, have but three. Most of the Isle of Pines series are immature birds, with the dusky-spotted head

and neck and dark back and wings characteristic of this stage. Individuals in first nuptial dress are like the adults except for the dusky mottling of the head and neck, which persists from the juvenal plumage, and similar indications on the subterminal portion of the outer primaries. Several of the immature birds above recorded show scattered white feathers in the dark areas, but I am not sure that such indicate the onset of a moult; they were more probably acquired at the same time with the others, showing as they do the same degree of wear.

This is one of the commonest and most characteristic water-birds of the island. Although of course not found in the dry parts of the interior, it is generally distributed wherever there is water, particularly about the coastal lagoons and the larger streams, where it affects the mangrove growths. It is naturally very abundant in the Cienaga, flocks of forty or fifty having often been seen near Pasadita by Mr. Zappey. This observer says that the inhabitants sometimes catch and tame the young birds, which will associate with the domestic fowls and feed on table scraps. Mr. Link found the White Ibis very numerous at the western end of the Cienaga, near Sigüanea, in October and April, at both of which seasons it was observed in flocks. No nests were found, nor yet any very young birds. Its food consists of crabs, snails, frogs, and lizards. Its flesh is regarded as very good.

24. **Mycteria americana** Linnæus. WOOD IBIS.

*Tantalus loculator* CORY, Cat. W. Indian Birds, 1892, 89 (I. of Pines, in geog. distr.).

—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 189 (I. of Pines, ex Cory).

*Mycteria americana* COOKE, Bull. Biol. Survey, No. 45, 1913, 22 (I. of Pines, ex Cory).

There is of course no reason why the Wood Ibis should not occur in the Isle of Pines as well as in Cuba, but the only published record is the very indefinite one above quoted. It was described to Mr. Link by one of his guides as having been seen on one occasion near the Casas Mountains shortly after the close of the Spanish War, but none have been observed for many years.

25. **Phœnicopterus ruber** Linnæus. FLAMINGO.

*Phœnicopterus ruber* CORY, Cat. W. Indian Birds, 1892, 88 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 255 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 189 (Punta del Este and Bibijagua).—COOKE, Bull. Biol. Survey, No. 45, 1913, 10 (I. of Pines, ex Gundlach).

Although the Flamingo is attributed to the Isle of Pines by Mr. Cory, presumably on the authority of Gundlach, as well as by Gundlach



himself, the first definite and circumstantial record is that given by Messrs. Bangs & Zappey: "A few Flamingoes inhabit Punta del Este and Bibijagua. None were seen alive, but one morning the tracks of about a dozen were found in the mud, and on another occasion three individuals that had just been shot by a native were examined." Mr. Link made special search and inquiry for this species, but without result. There is a considerable area on the "south coast" and in the Cienaga, however, which still remains a *terra incognita*, ornithologically speaking, and it is entirely possible that Flamingoes may yet be found breeding somewhere in these parts, since it seems unlikely that they would stray all the way from Cuba.

26. *Querquedula discors* (Linnæus). BLUE-WINGED TEAL.

*Querquedula discors* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 189 (Cienaga).

Two specimens: Rincon Lagoon.

A winter resident in the Isle of Pines, as elsewhere in the West Indies. Mr. Zappey found it in considerable numbers in the Cienaga in March, 1902, although none were seen on his second trip, all probably having already gone north. Mr. Link met with the species but once (February 21), on which occasion he shot two fine adult males from a flock of twelve birds encountered at a lagoon near Bibijagua.

27. *Dendrocygna arborea* (Linnæus). ANTILLEAN TREE DUCK.

*Dendrocygna arborea* CORY, Cat. W. Indian Birds, 1892, 87 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 189 (Santa Fé and the Cienaga; habits).—READ, Oölogist, XXVI, 1909, 190, and XXVIII, 1911, 11 (I. of Pines).

"West Indian Tree Duck" READ, Oölogist, XXVIII, 1911, 6, and XXX, 1913, 123 (Nuevas River); XXVIII, 1911, 114 (West McKinley); XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines).

Six specimens: Siguanea.

One shot November 14 is in worn and faded breeding dress, but the other five, taken April 26 and 28, are in perfectly fresh plumage. All were shot at the western end of the Cienaga near Siguanea, where the species was quite common. Mr. Zappey found it numerous also in May, in the eastern part of the Cienaga. "During the day it keeps concealed in the Cienaga, but in the evening, toward dusk, it leaves the swamps to feed in the royal palms, alighting on the trees and picking off the berries. One night a half a dozen or so alighted in the palms in the plaza at Santa Fe. The call note of this bird is

much like that of the Wood Duck (*Aix sponsa*).” Mr. Read has noted it several times in the northern part of the island, along the Nuevas River. Mr. Link observed a few at Rincon Lagoon, also along the Los Indios River, and at Pasadita. It was never seen swimming about in the water like other ducks, but usually wading about in the swamps, or perched in the adjoining mangroves. The stomachs of those examined contained grass. The natives sometimes tame the young birds, several of which were seen running about the houses like domestic ducks. No nesting records were obtained.

28. **Chen hyperboreus nivalis** (Forster). GREATER SNOW GOOSE.

*Chen hyperborea nivalis* CORY, Cat. W. Indian Birds, 1892, 87 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 189 (I. of Pines, *ex* Cory and Gundlach).—COOKE, Bull. Biol. Survey, No. 26, 1906, 67 (I. of Pines [*ex* Gundlach]).

*Chen hyperborea* GUNDLACH, Orn. Cubana, 1895, 257 (I. of Pines).

According to Gundlach this species has appeared in Cuba as a winter resident in considerable numbers, and he records it from the Isle of Pines without special comment, although it has not been detected there by any of the more recent workers. It has been recorded from Jamaica, however, as well as from Porto Rico, but according to Prof. Cooke is not common as a rule anywhere south of North Carolina.

29. **Cathartes aura aura** (Linnæus). SOUTHERN TURKEY VULTURE.

*Cathartes aura* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach; habits).—CORY, Cat. W. Indian Birds, 1892, 98 (I. of Pines, in geog. distr.).—NELSON, Proc. Biol. Soc. Washington, XVIII, 1905, 122 (I. of Pines; crit.).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).

*Cathartes aura aura* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 190 (Santa Fé; crit.; meas.).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

(?) “Carrión Crow” READ, Oölogist, XXVI, 1909, 58 (I. of Pines), 102 (crit.; “probably an immature Turkey Buzzard”).

“Turkey Buzzard” READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 84 (Los Tres Hermanos Mountains); XXX, 1913, 123 (McKinley).

“Southern Turkey Buzzard” READ, Oölogist, XXVII, 1910, 5, and XXVIII, 1911, 6, 10 (Nuevas River), 3 (McKinley), 5 (Santa Barbara Mountain, etc.), 7 Cañada Mountains, etc.), 113 (West McKinley); XXX, 1913, 125 (Santa Barbara), 130 (I. of Pines), 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).

(?) *Catharista uruba* [*sic*] READ, Oölogist, XXVIII, 1911, 11 (crit.; “possibly an immature Turkey Buzzard”).

One specimen: Los Indios.



Mr. Nelson refers specimens of the Turkey Vulture from the Isle of Pines, Cuba, southern Mexico, and Central America to true *aura* of Linnaeus, which he distinguishes from the northern form (*C. a. septentrionalis* Wied) by its smaller size, narrower and less well-marked brown borders to the feathers of the back, and the usually lighter color of the shafts of the primaries. The Los Indios skin (a female) measures as follows: wing, 495; tail, 245; tarsus, 60. It is appreciably darker and blacker below, especially posteriorly, than any of the northern examples with which I have been able to compare it, and while it has less brown above than the average northern bird, it can be matched very closely by a skin from Colorado. The only other specimen of supposedly true *aura* at present available is a female from Mamatoco, near Santa Marta, Colombia. This measures as follows: wing, 502; tail, 257; tarsus, 65. It is absolutely the same as northern birds in color, and exceeds several of them in size. Although the series of this species at hand for study is admittedly small, it leaves the impression that the characters relied on to distinguish the two supposed races are too slight and inconstant to justify any such formal separation. At any rate, not one of the individuals measured is as large as those referred to by Mr. Nelson, although several are in fine fresh plumage. No Brazilian skins have been seen; they are said to be decidedly smaller.

This is one of the most common and universally distributed large birds of the island. Poey refers at some length to the habits of this vulture as observed on the north coast, and the references above listed will serve as a summary of the numerous published records of later observers. As elsewhere in the tropical regions of the New World, it is numerous in the vicinity of towns and cultivated lands, where it is seldom molested, being valued so highly for its services as a scavenger. Mr. Link in the month of June found it frequenting crevices in the rocks near the top of the Casas Mountains, where it was doubtless nesting.

30. ***Rostrhamus sociabilis*** (Vieillot). EVERGLADE KITE.

*Rostrhamus sociabilis* CORY, Cat. W. Indian Birds, 1892, 98 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 14 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 191 (Cienaga and Santa Rosalia Lagoon; food). "Everglade Kite" READ, I. of Pines News, VI, May 30, 1914 (I. of Pines).

Gundlach says that this species is very common in the Zapata Swamp in Cuba and in the Isle of Pines. Mr. Zappey found it

common in the Cienaga, where, however, it was not met with by Mr. Link, although he made special search. It may be of very local distribution, or possibly its numbers have been reduced in the last few years almost to the vanishing point. Mr. Read seems not to have encountered it either, and it is difficult to account for its apparent absence.

### 31. *Circus hudsonius* (Linnæus). MARSH HAWK.

"Marsh Hawk" READ, *Oölogist*, XXVI, 1909, 224 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 7 (I. of Pines, Nov. 26), 114 (West McKinley, Oct.); XXX, 1913, 130 (I. of Pines, winter).

*Circus hudsonius* READ, *Oölogist*, XXVIII, 1911, 11 (I. of Pines); I. of Pines News, VI, May 30, 1914 (I. of Pines, winter).

One specimen: Los Indios.

A winter resident, apparently not very common. Mr. Link saw a few in the marshy country around Los Indios and the Majagua River from October on, securing a single bird on January 13. Mr. Read has observed it several times in the northwestern part of the island, his earliest fall record being October 12 (1909). According to Gundlach it is not rare in Cuba, although not known from any of the other Antilles.

### *Buteo platypterus cubanensis* Burns. CUBAN BROAD-WINGED HAWK.

"Broad-winged Hawk" READ, *Oölogist*, XXVII, 1910, 84 (Los Tres Hermanos Mountains); XXX, 1913, 131 (I. of Pines).

*Buteo platypterus cubanensis* BURNS, *Wilson Bull.*, XVIII, 1911, 148, in text (diag.), 195 (Los Tres Hermanos Mountains, *vide* Read).

*Buteo platypterus* READ, I. of Pines News, VI, May 30, 1914 (I. of Pines).

Mr. Frank L. Burns has ventured to separate (provisionally at least) the Broad-winged Hawk of Cuba and Porto Rico under the above name. The only record for the Isle of Pines is based on a field-glass identification by Mr. Read, who says that he saw a pair circling about the crown of Los Tres Hermanos Mountains, near Nueva Gerona, on April 3, 1910. While there is of course nothing intrinsically improbable in the occurrence of this species in the island, it is deemed best not to formally admit it to the present list until more conclusive evidence is adduced.

### 32. *Urubitinga gundlachii* (Cabanis). CUBAN CRAB HAWK.

*Hypomorphus gundlachi* POEY, *Mem. Hist. Nat. Cuba*, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Urubitinga anthracina* (not *Falco anthracinus* Lichtenstein) CORY, *Cat. W. Indian Birds*, 1892, 99 (I. of Pines, in geog. distr.).—GUNDLACH, *Orn. Cubana*, 1893, 18, 19 (I. of Pines; nesting).—BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 191 (I. of Pines, *ex* Poey; crit.).

*Urubitinga gundlachii* BANGS, Auk, XXII, 1905, 307 (I. of Pines, *ex* Gundlach; crit.).—READ, Oölogist, XXX, 1913, 131 (I. of Pines); I. of Pines News, VI, May 30, 1914 (Cienaga and "south coast;" descr.; nesting).  
"Cuban Crab Hawk" READ, Oölogist, XXX, 1913, 125 (Santa Barbara), 168 (Los Indios).

Seven specimens: Los Indios and Caleta Grande.

Many years ago Poey recorded this species from the Isle of Pines on the authority of Gundlach, which author later speaks of having found a nest there, built in a "jucaro" tree, and constructed of twigs like those of other hawks. "The egg was dirty white with a greenish tinge. At the larger end were some very pale lilac spots. The dimensions were 58 by 45 millimeters." (Translation.) Mr. Zappey failed to meet with the species in the island, however, and in the absence of specimens Mr. Bangs was perforce obliged to follow Gundlach and other authors in considering it the same as the continental species, *U. anthracina*. Shortly thereafter, however, the receipt of a fine pair of adults from the coast of Cuba afforded the much desired opportunity for comparison, which showed that the Cuban and continental forms were quite distinct. The present series, which includes two adult birds, abundantly confirms this conclusion, although I cannot agree with Mr. Bangs that *U. gundlachii* is only distantly related to *U. anthracina*. In form, proportions, and style of coloration the two species are practically alike, but they may be separated at a glance by their different colors. *U. gundlachii* is chocolate-brown, with a slight purplish gloss, where *U. anthracina* is black, except the tail, which is about the same color in both. The bases of the remiges are broadly white underneath in *U. gundlachii*, but merely mottled with white in *U. anthracina*. With a fairly representative series of the latter before me, I fail to appreciate any constant differences in the position and extent of the white bands on the tail, to which Mr. Bangs calls attention. In fact, this is a variable character in *U. anthracina* at least, and little importance can be attached to it. The feathers of the upper parts are decidedly paler basally in *U. gundlachii* than in *U. anthracina*, and the outer webs of the primaries lighter gray. Immature birds, too, are duller in color than those of *U. anthracina*, and the barring on the tibiae and tail is not so coarse. The iris is given as dark brown in the adults and light brown in the young.

Mr. Link met with this species only in the southwestern part of the



island, at Caleta Grande, Los Indios, and near the mouth of the Majagua River. Invariably it was found among the mangroves, on the lookout for the various kinds of crabs which constitute its main article of diet. It was singularly tame and unsuspecting, and could be approached without special precautions. It was usually observed singly, and never more than two together. About a dozen or fifteen individuals in all were observed, so that it can scarcely be considered a common bird. Mr. Read claims to have seen it on the Santa Barbara tract.

33. *Falco peregrinus anatum* Bonaparte. DUCK HAWK.

*Falco peregrinus anatum* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 191 (I. of Pines).

"Duck Hawk" READ, I. of Pines News, VI, May 30, 1914 (I. of Pines).

A winter resident in the West Indies. The only Isle of Pines record is that quoted above, which refers to a bird examined in March, 1902, by Mr. Zappey, under somewhat unusual circumstances. It had "struck and killed a hen, and being either unable or unwilling to let go, was chopped to pieces by some natives with their machetes."

34. *Falco columbarius columbarius* Linnæus. PIGEON HAWK.

*Falco columbarius* CORY, Cat. W. Indian Birds, 1892, 99 (I. of Pines, in geog. distr.).

*Hypotriorchis columbarius* GUNDLACH, Orn. Cubana, 1893, 29 (I. of Pines).

*Falco columbarius columbarius* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 191 (I. of Pines, ex Cory and Gundlach).

Like the last a winter resident, but much more numerous, having been repeatedly observed by Mr. Link at Los Indios in September, following the immense flocks of doves which were frequenting the open country at that season. On one occasion an individual was noted in pursuit of a pair of the larger pigeons (*Columba inornata proxima*). None were noticed in the spring, however.

35. *Falco sparveroides* Vigors. CUBAN SPARROW HAWK.

*Falco sparverius* (not of Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, fide Gundlach).

*Cerchneis sparveria dominicensis* (not *Falco dominicensis* Gmelin) BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 191 (Santa Fé, San Juan, Jucaro, Laguna Grande, and Los Almacigos; plum.; habits).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines); I. of Pines News, VI, May 30, 1914 (I. of Pines; descr.; habits).

"Cuban Sparrow Hawk" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58, 102, and XXX, 1913, 130 (I. of Pines); XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley

and Santa Barbara Mountain, etc.), 6, 10, 123 (Nuevas River), 7 (Cañada Mountains, etc.), 113 (West McKinley); XXX, 1913, 123 (Nuevas River), 125 (Santa Barbara).

*Falco sparveroides* READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

*Falco sparverius sparveroides* BANGS, Auk, XXXII, 1915, 484 (I. of Pines; crit.).

Thirteen specimens: Bibijagua, Los Indios, and Nueva Gerona.

Three of the males have the back immaculate, but in the other males it is spotted, and in one case as heavily barred as in *F. sparverius loquacula* of Porto Rico. The spotting on the sides is prominent in some specimens, but absent in others. The tail-pattern, however, is fairly constant—far more so than in the Porto Rican bird. The rufous crown-spot is barely indicated in a few of the males, but in several of the females it is large and prominent. In only one of the females do the markings of the under surface approximate in intensity the average of those in true *F. sparverius*. Males taken July 9 and 11 are in the midst of the postnuptial moult. Only one specimen of this series is in the dark phase.

If this form is a distinct species, as ranked by most authors, its distribution is certainly most peculiar, occupying as it does an area between that of two other forms which are unquestionably merely geographic races of *F. sparverius*, the range of which thereby becomes discontinuous. According to Mr. Cory (*Catalogue of West Indian Birds*, 1892, 139) the Santo Domingo bird (*Falco dominicensis* Gmelin) is separable from that of Cuba, differing in having no dark phase, as well as in other respects. Mr. Cory bases his statement on the examination of no less than forty-six specimens from Haiti and Santo Domingo. If he is correct, there can remain no valid reason for refusing recognition to *dominicensis* as an insular race of *sparverius*. A due regard for consistency would require also that the light phase of the Cuban bird (to which Mr. Ridgway applied the name *leucophrys* in 1870), be recognized in a similar way, but complications immediately arise upon attempting to include the dark phase in such an arrangement. The case has been very fully discussed by Mr. Chapman (*Bulletin American Museum of Natural History*, IV, 1892, 295), who points out that the dichromatism in this species is unusual in that it involves also certain changes in the pattern of coloration. That such a striking variation should have developed in only a comparatively restricted portion of the range of the *Falco sparverius*

group makes the case all the more remarkable and interesting, and suggests that while the light phase is probably subspecifically related to *F. sparverius*, as already intimated, the dark phase may be in reality a distinct species, which is common in Cuba and rare in the Isle of Pines, but does not extend to Haiti and Santo Domingo. Indeed, this was substantially the view of the case accepted by the earlier authors. As far back as 1855, however, Gundlach (*Journal für Ornithologie*, "1854," 1855, extraheft, p. lxxxiv), insisted that such could not be the case, since he had found the two supposed species paired together. On the strength of a series of specimens sent by him to the U. S. National Museum Mr. Ridgway (*Auk*, VIII, 1891, 113) accepted this conclusion, which so far as I am aware has not been seriously questioned since. It is significant, however, that Mr. Chapman, in the paper referred to above, says that of all the Sparrow Hawks secured or observed by him in Cuba, light and dark, on no occasion did he find birds of different phases mated. That such unions occasionally occur, however, can scarcely be questioned in view of Gundlach's testimony, but the fact need in no way militate against the view here advanced that two species may be involved. The variability of the dark birds would then be explainable by what we now know of the laws of inheritance, and even the fact (if it is a fact) alleged by Mr. Cory, that light and dark birds have been taken from the same nest, on a similar hypothesis. This is certainly a case demanding further investigation in the field, as in no other way can a final conclusion be reached. While I do not venture at present to make the formal nomenclatural shift indicated, I predict that this will eventually be found necessary.

The recognition of a genus *Cerchneis* for the American Sparrow Hawks, while doubtless justifiable, seems to me to involve also the raising of certain other groups of *Falco* to generic rank, and as I have neither the time nor the material for an investigation of this kind, I follow for the present the nomenclature of the American Ornithologists' Union *Check List of North American Birds*.

This is the commonest hawk in the Isle of Pines, being generally distributed in the drier parts, back from the coast and the rivers. Nests with young birds were found about Nueva Gerona and Los Indios in April and May, built in holes in dead palm- and pine-trees, twenty or thirty feet up. The birds of this species are wont to follow the fires kindled by the natives in clearing the land of brush and

grass, feeding on the lizards dislodged by the flames. Mr. Zappey saw but a single individual in the dark phase, Mr. Link only one, and Messrs. Palmer and Riley none at all, which circumstance tends to show how rare it is in the island as compared with Cuba.

**36. *Polyborus cheriway* (Jacquin). AUDUBON CARACARA.**

*Polyborus vulgaris* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Polyborus cheriway* CORY, Cat. W. Indian Birds, 1892, 99 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 191 (Santa Fé; habits).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45 (Santa Barbara); I. of Pines News, VI, May 30, 1914 (I. of Pines).

"Caracara" READ, Oölogist, XXVIII, 1911, 114 (West McKinley); XXX, 1913, 125 (Santa Barbara), 130 (I. of Pines).

One specimen: Nueva Gerona.

The Caracara is confined in the West Indies to Cuba and the Isle of Pines, where it is not a common bird, and is moreover shy and difficult of approach. Messrs. Palmer and Riley saw one each at both Manigua and Nueva Gerona, and Mr. Link secured a single immature example at the latter locality on January 29. Others were observed at Los Indios and Bibijagua, and on one occasion, near Santa Fé, as many as a half-dozen together, feeding on the carcass of a cow. Individuals were repeatedly seen following in the wake of the fires started to burn off the old crop of grass, in search of the bodies of the lizards, snails, etc., which were left behind. The specimen secured by Mr. Zappey near Santa Fé is said to be indistinguishable from Florida examples.

**37. *Pandion haliaëtus carolinensis* (Gmelin). OSPREY.**

*Pandion haliaëtus carolinensis* CORY, Cat. W. Indian Birds, 1892, 99 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 192 (I. of Pines, *ex* Cory).

"Fish Hawk" READ, I. of Pines News, VI, May 30, 1914 (I. of Pines).

This species is recorded by Mr. Cory, but was not observed either by Mr. Zappey or Messrs. Palmer and Riley, nor has Mr. Read ever met with it. The single individual noted by Mr. Link was seen at Caleta Grande on April 21, sailing about high overhead. It is unaccountably rare in this section.

38. *Colinus cubanensis* (Gould). CUBAN BOB-WHITE.

*Colinus cubanensis* CORY, Cat. W. Indian Birds, 1892, 96 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 171 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 192 (Santa Fé, Nueva Gerona, and Cayo Bonito).—READ, Oölogist, XXVI, 1909, 102, and XXVIII, 1911, 13 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, I. of Pines News, VI, Apr. 18, 1914 (I. of Pines; habits).

"Bob-white" READ, Oölogist, XXVI, 1909, 57 (I. of Pines).

"Quail" READ, Oölogist, XXVI, 1909, 58 (I. of Pines), 102 (crit.).

"Cuban Bob-white" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVIII, 1911, 13 (West McKinley).

"Cuban Quail" READ, Oölogist, XXVIII, 1911, 3, 5 (McKinley; nesting), 10, and XXX, 1913, 123 (Nuevas River), 125, 127 (Santa Barbara), 130 (I. of Pines), 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).

Twelve specimens: Bibijagua, Los Indios, and Nueva Gerona.

No two of the males in this series are exactly alike. Several have the under surface from the breast down more or less spotted with buffy white in irregular pattern: these are doubtless younger birds in first winter or first nuptial dress, according to season. But even in the case of individuals presumably adult there is much variation as regards the character and extent of the black streaking on the lower breast.

Although given by some authors as a subspecies of *C. virginianus*, this form is clearly entitled to rank as a full species, being indeed closer to some of the Mexican forms than to that of peninsular Florida. The latter, however, has been introduced into Cuba, where it has interbred with the native species to such an extent that in many localities it is now difficult, so Dr. Thomas Barbour tells me, to secure specimens which do not show traces of such mixed ancestry. The Isle of Pines birds, however, are presumably pure-bred.

Except in the breeding season, which extends from May to July, the Cuban Bob-white is generally found in coveys or family groups, frequenting the dry pastures, especially where there are low palmettos for shelter. In notes and habits it closely resembles *C. virginianus*. A nest with ten eggs was found July 10, 1912, on the El Bobo plantation northeast of McKinley, and Mr. Read mentions having found young birds just able to fly on August 1, near the same place. Indeed he claims that this species breeds more than once in a season. The eggs are pure white, unmarked, like those of *C. virginianus*. The species is common and generally distributed throughout the dry interior of the island, but is of course absent from the region south of the Cienaga. Being one of the recognized game-birds, it is hunted



by the inhabitants for food and sport during the open season, from September to April inclusive. In spite of this, and of the death of many young birds which perish during the rainy season, it appears to be holding its own fairly well. It is like the Bob-white of the north in being a great destroyer of noxious insects, and a covey on a plantation is an invaluable asset.

39. **Rallus elegans ramsdeni** Riley. CUBAN KING RAIL.

*Rallus elegans?* (not of Audubon) BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 192 (Cienaga).

(?) "Virginia Rail?" READ, Oölogist, XXVIII, 1911, 7, 13, and XXX, 1913, 131 (I. of Pines).

Two specimens: Siguanea.

MEASUREMENTS.						
No.	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus
41304 <sup>7</sup>	♀	Siguanea, I. of Pines.....	141	53	46	52
41305 <sup>7</sup>	♂	Siguanea, I. of Pines.....	150	60	57	54
233478 <sup>8</sup>	♂	Guantánamo, Cuba.....	149	53	57	54.5
Four adult males from eastern U. S., average.....			166	68	58.5	58.5

Although the King Rail was long ago recorded as resident in Cuba by Gundlach, no specimens seem to have found their way into collections until quite recently, when Mr. Charles T. Ramsden sent a small series to the U. S. National Museum for examination. Mr. Joseph H. Riley was thus enabled to prove the correctness of his surmise as to the distinctness of the Cuban bird, which he accordingly named in honor of Mr. Ramsden (*Proceedings Biological Society of Washington*, XXVI, 1913, 83). As might be expected, the Isle of Pines bird also belongs to the same small, pale race. The two specimens above recorded, although not actually compared with the type of *ramsdeni*, differ from examples from the eastern United States in the chief respects pointed out in Mr. Riley's diagnosis. Besides being smaller, they have much whiter throats and bellies, and the color of the breast also is decidedly paler, less rufescent, than in the dullest colored skins of true *elegans* available. The statement "sides of head behind eye paler" holds only for the female, the male being different, more like *elegans*, in this respect, so that this can scarcely be used as a diagnostic character.

Besides the pair taken at Siguanea, several others were seen there,

<sup>7</sup> Collection Carnegie Museum.

<sup>8</sup> Collection U. S. National Museum; measurements as given by Mr. Riley.

all in fresh or nearly fresh water. It was found at Los Indios also, about three miles up the river from the coast, and one was shot at Pasadita, in the Cienaga, the latter part of May, but not preserved. Mr. Zappey secured several specimens at the latter locality in March, 1902, but because he did not chance to get any on his second trip he inferred that the species did not breed in the island. We now know, however, that it is a resident in the fresh-water marshes of both Cuba and the Isle of Pines, and doubtless all the birds seen by Mr. Link were breeding at the time. The "Virginia Rail" mentioned by Mr. Read as having been noted on sundry occasions (in fresh-water sloughs only) is doubtfully referred to the present species, no specimens having been taken.

40. *Rallus longirostris leucophæus* Todd. ISLE OF PINES CLAPPER RAIL.

(?) "Virginia Rail?" READ, Oölogist, XXVIII, 1911, 146 (Bibijagua).

*Rallus longirostris leucophæus* TODD, Proc. Biol. Soc. Washington, XXVI, 1913, 174 (Majagua River; orig. descr.; type in coll. Carnegie Museum).

Eight specimens: Los Indios and Majagua River.

*Type*, No. 39,717, Collection Carnegie Museum, adult male; Majagua River, Isle of Pines, November 7, 1912; Gustav A. Link.

*Description*.—General color of upper parts deep clove-brown or brownish black with an olivaceous shade, all the feathers margined with neutral gray, giving a streaked appearance, these edgings very broad and prominent on the scapulars and tertiaries; tail like the back; wings dull brown, the upper coverts strongly shaded with buffy brown, the under coverts and axillaries dusky, narrowly barred with white; crown and back of the neck like the back, but duller, and the gray edgings indistinct; sides of head and neck dull grayish; suborbital spot and supraloral streak dull buffy white; throat white; lower throat and upper breast suffused with ochraceous buff; lower breast and abdomen (medially) dull white, the sides of the latter dusky, barred with white; under tail-coverts mostly white, with indistinct broad dusky barring; "iris dark brown."

MEASUREMENTS OF ADULTS.

No.	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus.
39571	♂	Los Indios.....	144	55	61	54
39684	♂	Los Indios.....	148	58	62	55
39717	♂	Majagua River.....	147	60	61	55
39610	♀	Los Indios.....	132	59	58	48
39627	♀	Los Indios.....	132	54	55	49

Some individuals show more or less decided traces of white bars on the upper wing-coverts also. Immature birds differ from adults in the color of the under parts, which are much darker, and suffused with grayish buffy.

The discovery of the Clapper Rail in the Isle of Pines, and that the birds of this species occurring there represent a new and very distinct form, is of more than passing interest. The new race, while closely resembling *R. l. waynei* of the South Atlantic coast in the color of the upper surface, is much whiter below than any of the other known forms of this group. That a sedentary species such as the Clapper Rail, which throughout its West Indian range has a habitat and environment practically the same—the mangrove swamps—should vary to such an extent is surprising enough, but that the Isle of Pines form should differ so widely from that of the neighboring island of Cuba, resembling instead certain other more remote forms, is a problem requiring consideration, suggesting that in the case of the Clapper Rail segregation has been a factor in the evolution of the species.

Since I wrote my review of Bahaman birds I have had occasion to alter my views as to the status of the various forms of this group. I now believe they should all stand as subspecies of the South American *Rallus longirostris*.

The present form is based upon a series of five adult and three immature birds, collected by Mr. Link at Los Indios and the Majagua River. It was confined to the mangroves, and seemed to be fairly common there, judging from the number which were daily heard. It proved to be very difficult to secure, however, preferring to seek safety when disturbed more by dodging through the thick growth rather than by flight. Young in the down were seen on several occasions along the sea-beach near the mouth of the Majagua River, upon being alarmed disappearing into the mangroves, where they were safe from pursuit. While not actually observed at any other locality than the two above mentioned, the species doubtless occurs at other points along the coast, in salt-water lagoons, wherever the mangroves grow, and it was probably this species which was recorded by Mr. Read from Bibijagua under the name "Virginia Rail."

41. *Gallinula chloropus cachinnans* Bangs.<sup>9</sup> FLORIDA GALLINULE.

*Gallinula galeata* (not of Lichtenstein) CORY, Cat. W. Indian Birds, 1892, 91 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 192 (Santa Rosalia Lagoon).

"Florida Gallinule" READ, Oölogist, XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines).

Mr. Zappey found a few Florida Gallinules in Santa Rosalia Lagoon in March, 1902, but saw none on his later trip. In Cuba, according to Gundlach, it is a regular breeder, so that it is entirely probable that in due time it will be found breeding in the Isle of Pines likewise. It seems, however, to be a rare bird there at any season. Mr. Read says that he saw a pair in the Santa Barbara tract in September, and while Mr. Link did not actually meet with a living bird, he found the remains of an individual at Los Indios in October, doubtless one which had been killed by a hawk.

42. *Ionornis martinica* (Linnæus). PURPLE GALLINULE.

*Ionornis martinica* CORY, Cat. W. Indian Birds, 1892, 91 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 192 (Pasadita; meas.; crit.).

Four specimens: Pasadita.

This is a fairly common species in the Cienaga at Pasadita, where specimens were collected by both Mr. Zappey and Mr. Link. Its local range, however, seems to be quite restricted, since it has not been detected at other points in the island, not even at the western end of the Cienaga, which Mr. Link explored carefully.

Messrs. Bangs and Zappey call attention to the large size of the birds collected by the latter as compared with specimens from the southern United States. With only a few specimens from South Carolina and Florida before me, however, it appears that several of these are quite as large as the Isle of Pines birds, the males of which fall below the measurements given by the authors in question. Females are somewhat smaller than males.

43. *Fulica americana* Gmelin. COOT.

*Fulica americana* CORY, Cat. W. Indian Birds, 1892, 91 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 249 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 193 (I. of Pines, *ex* Cory and Gundlach).

Gundlach appears to have been the only observer to record this species from the Isle of Pines, and his is merely a casual reference. He

<sup>9</sup> Mr. Bangs (*Proceedings New England Zoölogical Club*, V, 1915, 96) appears to have made out a good case for the subspecific status of the North American form.

says that in Cuba it comes from the north in large numbers for the winter, leaving in April, but that a few remain to breed. Under such circumstances it is odd that there are no more records from the Isle of Pines, where there are certainly many places suited to its needs.

44. *Aramus vociferus* (Latham). LIMPKIN.

*Aramus gaurauna* [sic] POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Aramus giganteus* CORY, Cat. W. Indian Birds, 1892, 90 (I. of Pines, in geog. distr.).

—GUNDLACH, Orn. Cubana, 1895, 237 (I. of Pines).—READ, Oölogist, XXVI, 1909, 149 (I. of Pines; habits); XXVIII, 1911, 11 (I. of Pines); XXX, 1913, 122 (McKinley; habits).—READ, I. of Pines News, VI, Jan. 31, 1914 (descr.; habits).

*Aramus giganteus holostictus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 194 (Cienaga; crit.; *ex Notherodius holostictus* Cabanis).

"Limpkin" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5, and XXVIII, 1911, 10 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (Nuevas River), 127 (Santa Barbara), 130, 131 (I. of Pines), 164 (Santa Barbara to Nueva Gerona).

Three specimens: Nueva Gerona and Pasadita.

MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus.
4342	♂	Melbourne, Florida.....	308	126	121	115
4343	♀	Melbourne, Florida.....	303	133	110	116
26959	♂	Bebedero, Costa Rica.....	325	146	120	122
27438	♀ im.	Lower Kissimmee R., Florida.....	300	127	104	112
27458	♂	Bassenger, Florida.....	319	140	131	126
39410	♂	Utuado, Porto Rico.....	306	139	—	103
41126	♀	Nueva Gerona, I. of Pines.....	310	134	121	120
41197	♂	Nueva Gerona, I. of Pines.....	318	149	118	125
41385	♀	Pasadita, I. of Pines.....	323	144	125	125

From the above table of measurements it must be obvious that West Indian specimens of this species vary in dimensions fully as much as do Florida birds, the variation in both being considerable. Nor, after careful comparison, can I detect any constant difference in color between the two series, such variation as exists seeming to depend largely on season, birds in fresher plumage being generally darker. Florida examples, it is true, seem to have rather more white on the under wing-coverts, but this is such a variable feature that I believe its value would disappear in a larger series. Some individuals have the under tail-coverts distinctly streaked with white, in others these



feathers are plain. Under the circumstances I am forced to the conclusion that the individual described by Messrs. Bangs and Zappey from the Isle of Pines was an unusually small, perhaps immature, bird, and that therefore their recognition of a subspecies *holostictus* from the West Indies, on the strength of this specimen, cannot stand.

So far at least as Mr. Link's experience goes, this is not a very common bird in the Isle of Pines. Two were shot at a lagoon north-east of Nueva Gerona, and one in the Cienaga at Pasadita. A few others were seen at the latter locality, as well as at El Canal, on the route between Santa Fé and the Cienaga, where they were observed in the dry uplands, in a plowed field. Mr. Zappey, however, saw none outside of the Cienaga. Messrs. Palmer and Riley heard several in the vicinity of Nueva Gerona, and Mr. Read has noted the species repeatedly at various points in the northwestern part of the island, remarking that it is solitary in its habits, and is oftener heard than seen. The fresh-water snails which abound in the rivers and lagoons constitute its principal food. "In the night it is a noisy bird, making weird, mysterious cries, from which it gets its name" [of "Crying Bird"]. Its ordinary alarm-note in the daytime is a frog-like croak. Nothing is yet on record regarding its breeding on the island.

**45. *Grus mexicana nesiotus* Bangs & Zappey. CUBAN SANDHILL CRANE.**

*Grus poliophæa* (not of Wagler) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Grus canadensis* (not of Linnæus) GUNDLACH, Journ. für Orn., 1875, 293 (I. of Pines; habits).—GUNDLACH, Contr. Orn. Cubana, 1876, 143 (I. of Pines).

*Grus mexicana* (not of Müller) CORY, Cat. W. Indian Birds, 1892, 90 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 175 (I. of Pines).—COOKE, Bull. U. S. Dept. Agric., No. 128, 1914, 10 (I. of Pines, *ex* Gundlach).

*Grus nesiotus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 193 (La Vega and Pasadita; orig. descr.; type now in coll. Mus. Comp. Zool.; habits; crit.).—ALLEN, Auk, XXII, 1905, 329, in text (review).—EDITORS, Ibis, 1905, 631, in text (review).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines); XV, 1913, 45 (Santa Barbara).—READ, I. of Pines News, VI, Feb. 7, 1914 (I. of Pines; habits).

"Sand-hill Crane" READ, Oölogist, XXVI, 1909, 58 (I. of Pines), 102 (syn.).

"Cuban Crane" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVIII, 1911, 7 (Cañada Mountains, etc.), 113 (West McKinley); XXX, 1913, 123 (Pine River), 125 (Santa Barbara), 130 (I. of Pines).

Three specimens: Los Indios.

The measurements given in the following table, having been taken by different individuals, are possibly not entirely comparable, although

doubtless sufficiently so to show the relative size and proportions of the three forms under consideration.

*Grus mexicana mexicana:*

No	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus.
36115 <sup>12</sup>	♂	Plymouth, Ohio.....	490	196	152	230
162903 <sup>11</sup>	♂	Lake Trafford, Florida.....	505	200	131	258
162904 <sup>11</sup>	♂	Fort Thompson, Florida.....	485	185	129	252
175530 <sup>11</sup>	♂	Lake Kissimmee, Florida.....	503	185	128	258
17451 <sup>13</sup>	♂	Bassenger, Florida.....	525	179	142	258
17452 <sup>13</sup>	♀	Bassenger, Florida.....	501	174	138	237
175408 <sup>11</sup>	♀	Sawgrass I., Polk Co., Florida.....	470	164	127	231
239548 <sup>11</sup>	♀	Elk River, Minnesota.....	515	195	130	223
1990 <sup>13</sup>	♀	Towner Co., North Dakota.....	577	196	134	240
24641 <sup>14</sup>	♀	Manatee Co., Florida.....	510	232	127	215

*Grus mexicana nesiotis:*

13238 <sup>10</sup>	♂	La Vega, I. of Pines.....	474	187	125	209
13239 <sup>10</sup>	♂	Pasadita, I. of Pines.....	460	171	123	204
39675 <sup>12</sup>	♀	Los Indios, I. of Pines.....	425	162	100	188
39676 <sup>12</sup>	♀	Los Indios, I. of Pines.....	431	171	110	198
41323 <sup>12</sup>	♀	Los Indios, I. of Pines.....	432	165	107	187
211220 <sup>11</sup>	♀	Puerto Principe, Cuba.....	475	171	124	214

*Grus canadensis:*

21614 <sup>12</sup>	♂	Emporia, Kansas.....	490	183	118	199
193556 <sup>11</sup>	♂	Ft. Resolution, Mackenzie.....	480	173	109	227
58485 <sup>11</sup>	♂	Ft. Kenai, Alaska.....	485	187	96	208
9937 <sup>13</sup>	♂	Nome, Alaska.....	463	161	82	161
18587 <sup>13</sup>	♂	Nome, Alaska.....	487	173	88	202
24639 <sup>14</sup>	♂	Carmon, Manitoba.....	541	192	124	217
33063 <sup>14</sup>	♂	Cameron Co., Texas.....	512	175	107	197
33062 <sup>14</sup>	♀	Cameron Co., Texas.....	490	207	97	200
38524 <sup>12</sup>	♀	Hooper Bay, Alaska.....	475	184	103	193
193555 <sup>11</sup>	♀	Slave River, 20 mi. above Ft. Resolution, Mackenzie.....	444	166	97	209
184977 <sup>11</sup>	♀	La Barca, Jalisco, Mexico.....	430	148	89	198
— <sup>11</sup>	♀	Nushagak, Alaska.....	430	158	88	184
25979 <sup>13</sup>	♀	Keith Co., Nebraska.....	458	154	90	184

The present series, secured by Mr. Link after strenuous and repeated efforts, has served as a basis for further and independent comparisons

<sup>10</sup> Collection E. A. and O. Bangs.

<sup>11</sup> Collection U. S. National Museum.

<sup>12</sup> Collection Carnegie Museum.

<sup>13</sup> Collection Louis B. Bishop.

<sup>14</sup> Collection Jonathan Dwight.

in an effort to determine the true status and relationships of the Sandhill Crane of Cuba and the Isle of Pines. Although known from the latter locality for many years, having been recorded by Poey (on Gundlach's authority) as far back as 1854, specimens have apparently been wanting in collections. In 1904, however, Mr. Zappey was successful in securing two male birds, which were described the following year under the name *Grus nesiotés*. The smaller size was given as the chief point of difference between the new form and *G. mexicana*, the differences in color being insignificant. As shown in the foregoing table of measurements, the two birds collected by Mr. Zappey, although in rather worn plumage, average somewhat larger than the three females taken by Mr. Link. Nevertheless, the bird represented by these five skins seems worthy of distinction from *G. mexicana* of the mainland, being so much smaller that its recognition is easy, but it is a curious fact (and one apparently ignored by the describers) that by this very token it approaches *G. canadensis*. Even in the small series of these two forms examined the measurements inosculate. But while in general size the two appear to be about the same, the bill in *nesiotés* seems to average relatively longer. The range of variation in this respect is nevertheless considerable in both forms, so much so that it is very doubtful if they can invariably be discriminated by any fixed differences in size or proportions. The status of *G. canadensis* has indeed been in the past the subject of considerable dispute, into the history of which it is here unnecessary to go; suffice it to say that current usage, as reflected by the American Ornithologists' Union *Check List of North American Birds*, accords it specific rank. Authorities are agreed that *G. canadensis* and *G. mexicana* can be distinguished from each other only by size, both species varying greatly in color, this variation affecting mainly the mantle, which is often strongly washed with brown. According to Messrs. Bangs and Zappey this brown wash is characteristic of the breeding-season, at least in the case of *G. mexicana*. Birds taken in May are quite appreciably browner than those taken in October, although the variation in this respect is not nearly so marked as in the other two forms, and it is of course possible that this difference may prove to be sufficiently constant to be used as a diagnostic character. It is of course inconceivable that *nesiotés* is a subspecies of the boreal and western *G. canadensis*, its real affinities being rather with *G. mexicana*, the range of which it approximates. To reduce it to a subspecies of the latter,

while at the same time keeping *G. canadensis* specifically distinct, may seem an inconsistent course to pursue; nevertheless, in the writer's judgment it more nearly expresses the facts of the case than to recognize it as a full species or (to go to the other extreme) to sink it as a synonym of *G. mexicana*. Indeed, Messrs. Bangs and Zappey seem to have been kept from following the arrangement here adopted merely by the consideration that the name *mexicana* has probably been improperly applied, a question on which I can at present express no opinion.

It may be added that future research may show that the bird of Cuba is not the same as that of the Isle of Pines. The measurements of the single Cuban example above given are those of an individual which died in captivity.

While the Cuban Sandhill Crane can by no means be considered a common species in the Isle of Pines, it nevertheless is a well-known and generally distributed bird. It has repeatedly been observed in the northern portion of the island by Mr. Read and Mr. Link, and by the latter at Pasadita also, where Mr. Zappey took one of his specimens. Three fine specimens were secured by Mr. Link at Los Indios. The two shot October 24 were taken by the ingenious device of dressing in green clothing and cautiously creeping towards the birds on hands and knees, their attention being distracted meanwhile by the manœuvres of another party at a distance, in the opposite direction. Frequenting the more open situations, as they invariably do, and being such wild and wary birds, it is seldom that they can be approached within gunshot, except by some such subterfuge as that just described. Their flesh is esteemed as food by the inhabitants, and they are shot for this purpose at every possible chance, but in spite of this persecution they have succeeded in holding their own fairly well. Mr. Link estimates that he saw as many as twenty-five individuals during his stay on the island. On one occasion a group of five were seen together, but as a rule not more than two or three were observed in company. In the latter case he believes that a pair with their young were represented. The Crane lays two eggs, but it is seldom that more than one young bird is raised, owing to the destruction caused by the ants, which often kill the young first hatched, while the one hatched later may escape. No nests were actually discovered, but broken egg-shells were found, and on several occasions young birds were seen in captivity, indicating that the eggs are laid early in May.

When taken young the Crane is easily tamed, and makes a very interesting pet. It feeds on worms, insects, lizards, etc., and may often be observed in recently burnt tracts, picking up the lizards which have perished in the fire. It is a very noisy bird, and also has a peculiar way of dancing, strutting around with bill pointed straight up, the wings spread, while all the time it utters its loud discordant notes.

46. *Sterna maxima* Boddaert. ROYAL TERN.

*Sterna cayennensis* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Sterna maxima* CORY, Cat. W. Indian Birds, 1892, 82 (I. of Pines, in geog. distr.).

—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 196 (seacoast and cays).

*Thalasseus maximus* GUNDLACH, Orn. Cubana, 1895, 287 (I. of Pines).

"Royal Tern" READ, Oölogist, XXX, 1913, 130 (I. of Pines), 168 (Los Indios).—  
READ, I. of Pines News, VI, Apr. 25, 1914 (Punta Frances).

Four specimens: Los Indios, Majagua River, and Cayo Frances.

Specimens shot September 27 and November 7 show moult of the primaries in progress, while an individual taken November 30 is in full dress.

The Royal Tern is found at various points along the seacoast and among the outlying cays. In addition to the localities above specified, it was noted off Punta del Este and about the island known as Morrillo del Diablo, on the north coast. Probably, however, none of these birds were breeding at the time. In May, 1910, a nest with two eggs was found near the sea-beach, east of the mouth of the Nuevas River.

47. *Sterna sandvicensis acuflavida* Cabot. CABOT TERN.

Three specimens: Los Indios.

A few were noted at Los Indios on September 27, in company with the Royal Tern, and three specimens were secured. One of these is an adult in winter dress; the other two are immature birds. The species has long been known from Cuba, Jamaica, and Porto Rico, but this is the first record for the Isle of Pines. So far as I have been able to discover there are no breeding records for Cuba, although Gundlach claims to have taken young in the first plumage in August.

48. *Sterna antillarum* (Lesson). LEAST TERN.

About a dozen of these birds were observed in May, 1910, about a sea-beach east of the mouth of the Nuevas River, under circumstances which indicated that they were breeding at the time, as were the Royal Terns, with which they were associated. The species was found



also in some numbers at Cayo Largo, an island some fifty miles east of the Isle of Pines, during a brief visit the latter part of May, and a specimen was secured.

49. **Himantopus mexicanus** (Müller). BLACK-NECKED STILT.

*Himantopus mexicanus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 195 (Bibijagua).

Mr. Zappey has been the only observer to meet with this species in the Isle of Pines. Two were seen, one of which was secured, in the "Salina" at Bibijagua on May 15, 1904. According to Prof. Cooke (*Bulletin Biological Survey*, No. 35, 1910, 20), "the species is a tolerably common resident of the entire West Indies," a statement confirmed by Gundlach (*Ornitología Cubana*, 1895, 222), so that its occurrence in the Isle of Pines is no more than was to be expected.

50. **Gallinago delicata** (Ord). WILSON SNIPE.

"Wilson Snipe" READ, Oölogist, XXVI, 1909, 224 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines).

*Gallinago delicata* READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).

The Wilson Snipe is a winter resident in the Isle of Pines, living in fresh-water swamps, where there is always plenty of suitable covert. The brush and marsh-grasses in these situations make shooting much more difficult than in the north, and although individuals were seen from time to time, none were actually secured. The first was observed at Bogarona on October 17, and others were noted in a marshy tract near the Caballos Mountains at intervals through the winter months. Mr. Read has recorded its arrival in fall migration as early as September 2 (1913), other records being September 18 (1912), October 3 (1911) and 21 (1909). No spring dates of departure are on record.

51. **Limnodromus griseus griseus** (Gmelin). DOWITCHER.

Seven specimens: Los Indios, Rincon Lagoon, and El Bobo Lagoon.

A single individual, the only one seen at the time, was shot at Los Indios on November 23. Several good-sized flocks were seen at Rincon Lagoon on February 21 and 22, and three weeks later (March 14 and 15) it was found in considerable abundance at El Bobo Lagoon. All of the specimens secured are in full winter dress with the exception of one from this latter locality, in which the prenuptial moult of the body-plumage is in progress, the bird presenting a curious pied appearance. The species is to be set down as a winter resident in the Isle of Pines, as elsewhere in the West Indies.

52. **Pisobia minutilla** (Vieillot). LEAST SANDPIPER.

"Least Sandpiper" READ, Oölogist, XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines).

Eight specimens: Los Indios and Siguanea.

Three birds taken September 27 are immature, one of them showing signs of moult of the body-plumage. Four others, ranging in date from September 30 to November 22, are in full winter dress, the earliest bird just completing the moult of the remiges. The single example from Siguanea, shot April 30, is in full nuptial plumage.

This diminutive species is a common winter resident, mainly on or near the coast, occurring in immense flocks, usually associated with other species of shore-birds. It was one of the most abundant species at Rincon Lagoon in February. September 27 was the earliest date of record for the fall of 1912, although Mr. Read seems to have noted it a little earlier that season, on September 24. In the fall of 1913 the same observer saw it first on September 26.

**Ereunetes pusillus** (Linnæus). SEMIPALMATED SANDPIPER.

(?) "Semipalmated Sandpiper" READ, Oölogist, XXVIII, 1911, 7, 13 (I. of Pines); XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines).

Mr. Read records this species, as above, saying that he saw several on September 4, 1910. In reply to an inquiry he writes that on the date in question he watched a flock of small sandpipers on a sand-bar along the Nuevas River, which from their partially webbed tracks he felt sure belonged to the present species. While there is no reason why this species should not occur as a winter resident in the Isle of Pines, as elsewhere in the West Indies, its formal admission to the list should await a more positive identification.

53. **Totanus melanoleucus** (Gmelin). GREATER YELLOW-LEGS.

*Totanus melanoleucus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 196 (Bibijagua).

—READ, Oölogist, XXVI, 1909, 190, and XXVIII, 1911, 11 (I. of Pines).

"Greater Yellow-legs" READ, Oölogist, XXVII, 1910, 15, XXVIII, 1911, 7, and XXX, 1913, 131 (I. of Pines; migr.).

Probably a winter resident in the Isle of Pines, as elsewhere in the West Indies, but the few available records pertain apparently to migratory birds only, or at least to individuals observed during the season of migration. Mr. Zappey secured a single female at the "Salina" near Bibijagua on May 15, 1904, and Mr. Read reports having seen a few on September 18, 1909, and September 7, 1910. Mr. Link failed to meet with the species.

54. *Totanus flavipes* (Gmelin). YELLOW-LEGS.

*Totanus flavipes* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 195 (I. of Pines, March).

"Yellow-legs" READ, Oölogist, XXX, 1913, 127 (Santa Barbara).

Six specimens: El Bobo Lagoon and Siguanea.

These specimens were collected on March 14 and 15 and April 30, flocks of considerable size having been met with on each occasion, frequenting the marshes back of the mangroves. On February 21 and 22 large flocks were observed at Rincon Lagoon, near Bibijagua. According to Prof. Cooke (*Bulletin Biological Survey*, No. 35, 1910, 56, 57) the species is rare as a winter resident so far north, although known to arrive in the Gulf States as early as March, so that the present record becomes of interest. Mr. Zappey also collected some specimens in March, 1902. All of the birds taken by Mr. Link show prenuptial moult of the body-plumage going on, and practically completed in the one shot April 30. One of the March specimens is renewing the outer primaries, and looks more like a bird just going into winter dress. Mr. Read writes that he has taken specimens of both this and the preceding species in fall shooting.

55. *Tringa solitaria solitaria* (Wilson). SOLITARY SANDPIPER.

*Helodromas solitarius solitarius* BANGS & ZAPPEY, Am. Nat., XXXIX, 905, 196 (Jucaro).

"Solitary Sandpiper" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, May 3).—READ, Oölogist, XXVI, 1909, 102 (I. of Pines); XXVII, 1910, 15 (I. of Pines, Oct. 27); XXVIII, 1911, 7 (I. of Pines, Aug. 20), 10 (Nuevas River), 114 (West McKinley); XXX, 1913, 125, 127 (Santa Barbara), 131 (I. of Pines). *Helodromas solitarius* READ, Oölogist, XXVIII, 1911, 11 (I. of Pines; migr.).

So far as known the Solitary Sandpiper is only a transient visitant in the Isle of Pines, although it is entirely possible that it may winter occasionally. Mr. Zappey secured a single bird at Jucaro on May 11, 1904, and Mr. Read has noted it (in the "West Coast" section) as early as March 25 (1913) and as late as May 18 (1910). Fall migration dates culled from his notes lie between August 20 (1910) and October 27 (1909).

56. *Catoptrophorus semipalmatus semipalmatus* (Gmelin). WILLET.

*Totanus semipalmatus* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Symphemia semipalmata* CORY, Cat. W. Indian Birds, 1892, 94 (I. of Pines, in geog. distr.).

*Catoptrophorus semipalmata* [*sic*] *semipalmata* BANGS & ZAPPEY, Am. Nat. XXXIX, 1905, 196 (I. of Pines, *ex* Poey).

Five specimens: Siguanea.

Judging from the measurements, these specimens belong to the typical eastern form. While agreeing well with an example from Amelia Island, Florida, taken May 8, they seem to differ slightly from a small series of breeding birds from Cobb's and Smith's Islands, Virginia, in having the under parts rather less heavily marked, and in the barring on the upper tail-coverts being less pronounced, or in one case even obsolete. The Virginia birds, however, vary somewhat among themselves in these respects, and possibly seasonal changes due to wear may be responsible for the observed differences.

The dates of collection of these birds (April 30–May 2) would at least suggest the possibility of their being breeding individuals. Moreover, the species was noted at Los Indios still later by several days. Gundlach says that he has observed the Willet at Guantánamo, Cuba, in June and July, and believes that a few breed there. Those noted in the Isle of Pines were invariably found in the marshes behind the fringe of mangroves, either singly or two or three together. The only other specific record is that of Poey, above quoted, based on Gundlach's observations near Nueva Gerona, which are doubtless the basis for Mr. Cory's reference also.

57. *Actitis macularia* (Linnæus). SPOTTED SANDPIPER.

*Actitis macularia* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 196 (I. of Pines, coastwise).—READ, Oölogist, XXVIII, 1911, 13 (I. of Pines).

"Spotted Sandpiper" READ, Oölogist, XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 6 (Nuevas River), 7 (I. of Pines; migr.); XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines).

Ten specimens: Los Indios, Santa Rosalia Lagoon, Bogarona, and Siguanea.

No. 39,699, October 29, is moulting the remiges. No. 39,760, November 16, is an adult completing the postnuptial moult, and still retaining the old wings and tail, as well as numerous black-spotted breast-feathers. Another individual, shot February 18, is renewing the remiges. All the birds taken between April 25 and 30 are in full nuptial dress.

A common winter resident, both inland and coastwise, although naturally not observed in the wooded parts of the Cienaga. The first was taken at Los Indios on September 30, but its real arrival evidently took place a month earlier, since Mr. Read has recorded it as early as August 29 (1913), August 31 (1910), and September 1 (1911). It was usually observed singly, although occasionally a small flock was encountered.

**Pluvialis dominicus dominicus** Müller. GOLDEN PLOVER.

(?) "Golden Plover" READ, *Oölogist*, XXX, 1913, 131 (I. of Pines, Sept. 18).

"On September 17, 1912, I took two specimens which I identified at the time as Golden Plover." These were "identified from Cory's 'How to know the Shore Birds,' and had the rudimentary hind toe." [1] The rudimentary hind toe being characteristic of the Black-bellied Plover, and not of the Golden Plover, there is ground for querying the record in question. Although the Greater Antilles are presumed to lie considerably off the regular migration route of the Golden Plover, Gundlach records it from Cuba without special comment, and, if it occurs there, it should also occur in the Isle of Pines.

**58. Squatarola squatarola** (Linnæus). BLACK-BELLIED PLOVER.

(?) "Black-bellied Plover" READ, *Oölogist*, XXX, 1913, 127 (Santa Barbara).

Seven specimens: Los Indios, Caleta Grande, and Rincon Lagoon.

After examining an unusually fine series of breeding and winter adults of this species from various parts of its North American range, together with a few European specimens, I find such a variation in size in both that I do not feel justified in recognizing the birds from the respective continents as subspecifically distinct (at least on the ground of size alone), as proposed by Messrs. Thayer and Bangs (*Proceedings New England Zoölogical Club*, V, 1914, 23). Nor does the supposed form "*hypomelus*" appear to rest on a much more satisfactory basis.

Two adults shot October 14 have completed the postnuptial moult, with the exception of one and two outer primaries respectively. Two young birds, dated respectively November 19 and 26, however, are still in juvenal dress, so badly worn that the buffy spotting of the upper parts is mostly scalloped out, and what remains faded to white; but still they show no signs of the onset of the postjuvenal moult. Three specimens shot February 21 and 22, and which look like winter adults, have the body-plumage much worn, while the wings, and also the tail, except in one individual, are quite fresh. The one exception referred to is a bird which is acquiring new feathers of the winter plumage on the back, and may be a young bird undergoing a late postjuvenal moult.

The Black-bellied Plover is a winter resident in the Isle of Pines, occurring usually wherever there are rocky or gravelly beaches exposed along the coast. Two or three individuals are ordinarily found together. At only one locality, Rincon Lagoon, near Bibijagua, February 21 and 22, was it ever observed in flocks of any size. October 14 was the earliest date recorded for it by Mr. Link, while a few individuals were observed at Siguanea as late as May 2. These latter



appeared to have some black feathers underneath, but they were very shy, and unfortunately none were secured. Mr. Read records what he believes to have been this species, mentioning that he has seen it feeding in the dry uplands, in pine-apple tracts.

59. *Oxyechus vociferus vociferus* (Linnæus). KILLDEER.

Five specimens: Caleta Grande, Los Indios, Santa Ana, and Nueva Gerona.

These specimens, taken at dates ranging from November 27 to February 24, compare favorably with examples from the eastern United States in size and other characters, indicating that they were migrants from that section, come to the Isle of Pines to spend the winter. The species was especially numerous at Caleta Grande, where on one occasion a flock of six or eight was encountered, but as a rule it was met with singly, or two together.

60. *Oxyechus vociferus rubidus* Riley. WEST INDIAN KILLDEER.

*Ægialitis vocifera* (not *Charadrius vociferus* Linnæus) CORY, Cat. W. Indian Birds, 1892, 95 (I. of Pines, in geog. distr.).

*Oxyechus vociferus* GUNDLACH, Orn. Cubana, 1895, 231 (I. of Pines).

*Oxyechus vociferus torquatus* (not *Charadrius torquatus* Pontoppidan) BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 195 (Nueva Gerona, *fide* Palmer & Riley, Bibijagua, and Laguna Grande; meas.; crit.; *ex Charadrius torquatus* Linnæus). —COOKE, Bull. Biol. Survey, No. 35, 1910, 88 (I. of Pines, in geog. distr.).

"West Indian Killdeer" READ, Oölogist, XXVI, 1909, 224, and XXX, 1913, 131 (I. of Pines), 123 (Pine River), 125, 127 (Santa Barbara).

"Antillean Killdeer" READ, Oölogist, XXVIII, 1911, 10 (Nuevas River).

*Oxyechus vociferus rubidus* READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).

Four specimens: Santa Rosalia Lagoon, Hato, and Jacksonville.

These four skins are evidently representatives of the race of the Killdeer which is resident in the West Indies, and which is readily distinguishable by its smaller size and lighter, generally more rusty color of the upper parts and wing-coverts. Measurements are as follows:

No.	Sex.	Locality.	Wing.	Tail.	Bill.	Tarsus.
41154	♀	Santa Rosalia Lagoon.....	158	92	20.5	35
41157	♂	Santa Rosalia Lagoon.....	149	85	20	33
41258	♀	Hato.....	144	90	20	32
41274	♂	Jacksonville.....	141	82	20	34

All are rather more worn than the specimens of true *vociferus*.

In discussing the status of this form as a bird of the Bahama Islands (ANNALS CARNEGIE MUSEUM, VII, 1911, 414), I inadvertently overlooked Messrs. Bangs and Zappey's record for the Isle of Pines, where it is a tolerably common resident, with habits the same as those of the northern form. Mr. Zappey found a downy young at Bibijagua, and Mr. Read has recorded it frequently, although it is probable that at least some of his records refer to the northern form, which is practically indistinguishable from the other in the open.

61. *Charadrius semipalmatus* (Bonaparte). SEMIPALMATED PLOVER.

Twelve specimens: Los Indios.

Four of these, shot at dates ranging from September 30 to November 12, show the delayed postjuvenal moult in progress, but it is a curious fact that in the remainder of the series, although taken between the same dates, there is no sign of moult. The bird shot September 30 is shedding the remiges and rectrices, while one shot November 4 is just completing the renewal of the former. Two taken November 12 are in similar case, and in addition are beginning to acquire the black feathers of the neck-band and forehead characteristic of the next plumage.

The Semipalmated Plover is a very abundant winter resident in suitable situations, thronging the sandy beaches in immense flocks from September until early in May. It was particularly numerous at Rincon Lagoon the latter part of February, associated with other species of shore-birds. It was not observed anywhere in the interior.

62. *Pagolla wilsonia wilsonia* (Ord). WILSON PLOVER.

*Oithodromus wilsonius rufinucha*? BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 195 (Playa Larga).

Eleven specimens: Los Indios.

All are in immature (or winter?) dress, having been shot between September 27 and November 23. Two birds, shot October 14 and November 12, show new black feathers coming in on the breast-band. The remiges seem fresh enough in these, but the body-plumage generally is old and worn. None of the skins show any approach whatever in their characters to the alleged subspecies "*rufinucha*," the status of which has already been fully discussed in another connection (ANNALS CARNEGIE MUSEUM, VII, 1911, 415), but unfortunately no breeding examples were collected. A series of such will be required to determine the status of the resident birds.

This is a very common species on the coast, wherever there are sandy beaches, as at Punta del Este, Los Indios, and Rincon Lagoon. Except in the breeding-season, it was usually observed in large flocks, often associated with the Semipalmated Plover.

63. *Arenaria interpres morinella* (Linnæus). RUDDY TURNSTONE.

Three specimens: Caleta Grande.

These birds were shot on November 26 and April 18 on the coral-beach at Caleta Grande, and were all that were seen. They were found singly, and not associated with any other shore-birds. All are in winter dress, and in the November birds the remiges are very fresh, in one case the outer primary still having the sheath attached.

64. *Jacana spinosa violacea* (Cory). WEST INDIAN JACANA.

*Jacana spinosa* (not *Fulica spinosa* Linnæus) CORY, Cat. W. Indian Birds, 1892, 92 (I. of Pines, in geog. distr.).

*Asarcia spinosa* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 196 (Santa Rosalia Lagoon, Laguna Grande, Pasadita, and the Cienaga; habits).

Eight specimens: Santa Ana and Pasadita.

The examination of a series of forty-six adult specimens of *Jacana spinosa*, brought together in order to determine the status of the bird of the Isle of Pines, shows conclusively that the sexes differ materially from each other in size, and also to a less extent in color. But unlike most birds, these differences are all in favor of the *female*, which is decidedly larger and somewhat more brightly colored than the male, and with a larger frontal lappet. The three exceptions to this rule in the series before me are unquestionably wrongly sexed specimens. So far as I have been able to discover, Gundlach (*Ornitología Cubana*, 1895, 237) was apparently the first author to note this fact, which is confirmed by Sharpe (*Catalogue Birds British Museum*, XXIV, 1896, 87) and Salvin and Godman (*Biología Centrali-Americana*, Aves, III, 1903, 343). There is no sexual difference affecting the color of the inner secondaries, however, as intimated by the former author. These sexual differences must constantly be kept in mind when comparing birds for geographic variation, else confusion is bound to ensue, as was evidently the case with Mr. Elliot (*Auk*, V, 1888, 299) and with Baird, Brewer & Ridgway (*Water Birds of North America*, I, 1884, 177), who must have been dealing with incorrectly sexed specimens, and could find no differences correlated with locality. With the material before me, however, I find no difficulty in recognizing no

less than three geographic races of this species. Average measurements are as follows:

	Wing.	Tail.	Bill.	Tarsus.
Nine males from Mexico.....	117	41	29	49
Six males from Central America.....	115	40	30	51.5
Ten males from the West Indies.....	116.5	40	30	51.5
Six females from Mexico.....	133.5	46	31.3	51
Five females from Central America.....	131	43.5	32	53.5
Ten females from the West Indies.....	132	44	33	55.5

Sex for sex, Mexican examples are decidedly duller and darker below than those from the West Indies, in which the maroon color of the under parts is much brighter. In the former series the greenish black of the breast merges more gradually into the maroon of the abdomen, which is often overspread with a shade of brown, while in the West Indian birds the transition is more abrupt, and the brown shade lighter or absent. The color-differences are no less marked above, although their character is reversed, for while the upper parts in the Mexican birds are lighter, more rufescent (nearer Hessian brown of Mr. Ridgway's *Color Standards and Color Nomenclature*), in the West Indian skins they are darker and more purplish (nearer maroon). There is also a decided difference in the size of the frontal lappet in favor of the latter series.

Taking up now the Central American series, which includes examples from Honduras, Nicaragua, Costa Rica, and Panama, we find them almost exactly intermediate between the Mexican and West Indian birds. With a larger series the slight discrepancy in size between Central American and Mexican birds shown by the above table would doubtless disappear. The frontal lappet, however, certainly averages larger in the former, although not so large as in the West Indian birds. In the color of the upper surface the Central American birds most resemble those from Mexico, while below they are almost as bright as those from the West Indies. In short, if the latter are to be separated at all, as I believe they should be, it will be necessary to recognize three races of this species instead of two. While selected specimens may be very similar, the average collective differences are quite sufficient in my judgment to justify subspecific separation, certainly as much so as in some other groups, the Ground Doves for instance.

Before the question of names for these three forms can be decided it will be necessary to fix the type-locality of *Fulica spinosa* Linnæus,

1758. This was based on the figure and description of the "Spur-winged Water-hen" of Edwards, *Natural History of Birds*, I, 1743, 48, pl. 48. Edwards gave the locality for his bird as Carthagera, Colombia, but this was almost certainly an error, inasmuch as there are no unquestioned records for the species from anywhere south of Panama, and so far as known *Jacana nigra* is the only species of this genus occurring on the north Colombian coast. *Parra variabilis* of Linnæus, 1766, has exactly the same basis as his earlier name. *Parra gymnostoma* Wagler (*Isis*, 1832, 517), and *Parra cordifera* Lesson (*Revue Zoologique*, 1842, 135) are both based on the Mexican bird, so that to reassign the type-locality on the basis of either of these authors would necessitate a new name for the Central American form. In order to obviate this, and to disturb the existing nomenclature as little as possible, I propose to fix the type-locality of *Fulica spinosa* Linnæus as Panama. This proceeding leaves Wagler's name available for the Mexican form.

*Parra violacea* Cory (*Bulletin Nuttall Ornithological Club*, VI, 1881, 130) is the only name so far proposed for the West Indian bird, the type coming from Haiti. The describer failed to compare his bird with continental examples, and neither the description nor the later plate (Cory, *Birds of Haiti and San Domingo*, 1885, pl. 19) are diagnostic. Indeed, in the latter volume Mr. Cory (page 159) refers his *P. violacea* to *P. gymnostoma* as a pure synonym, but later (*Auk*, V, 1888, 52) he provisionally restores it to the rank of a species, saying that Cuban specimens agree exactly with the Santo Domingo bird, being "considerably larger and brighter than specimens of *J. gymnostoma*; the coloration of the wattles is, I believe, also different." A few months later Mr. Elliot, in reviewing the species of this group (*Auk*, V, 1888, 299), repudiated the name in question, stating that he could find no differences between specimens of this species from various parts of its range. Unfortunately I have not been able to examine the type (which so far as I know is the only known specimen from Haiti) in this connection, but if the measurements given by Mr. Cory are correct it is evidently a female individual, and somewhat larger than the average, but equalled in this respect (except for length of tail) by an example from Trinidad, Cuba (No. 57,381, Collection American Museum of Natural History). Three males from this same locality also average larger than specimens of the same sex from western Cuba, the Isle of Pines, and Jamaica, notwithstanding which circumstance I consider them all as belonging to the same form.



The three forms here recognized may be diagnosed as follows:

- Frontal lappets small; upper parts more rufescent; under parts darker and duller.  
 (Mexico)..... *Jacana spinosa gymnostoma*.  
 Frontal lappets medium; upper parts more rufescent; under parts rather brighter.  
 (Central America)..... *Jacana spinosa spinosa*.  
 Frontal lappets large; upper parts more purplish; under parts decidedly brighter.  
 (West Indies)..... *Jacana spinosa violacea*.

It will thus be seen that my conception of a subspecies is essentially different from that of Mr. Hellmayr (*cf. Novitates Zoologicae*, XIII, 1906, 53), who considers that *J. "melanopygia"* and *J. spinosa* should stand as races of *J. jacana*, although I fully agree with him that the recognition of a separate genus *Asarcia* for *J. spinosa*, as proposed by Sharpe, is quite unnecessary.

The Jacana is a fairly common bird in the Isle of Pines, being apt to occur in almost any fresh-water lagoon. Messrs. Palmer and Riley shot three individuals in the vicinity of Nueva Gerona, where Mr. Link also observed it on several occasions, securing one specimen at Santa Ana, about three miles distant. It was abundant in the Cienaga in the neighborhood of Pasadita, specimens having been secured there both by Mr. Zappey and Mr. Link. None were observed near the western end of the Cienaga, however, the water being rather too brackish there.

65. ***Starnœnas cyanocephala* (Linnæus).** BLUE-HEADED QUAIL DOVE.

*Starnœnas cyanocephala* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 199 (Caballeros Mountains and "south coast"?).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines, one record).  
 "Blue-headed Quail Dove" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 102, and XXX, 1913, 131 (I. of Pines).

Messrs. Bangs and Zappey include this species in their list on purely hearsay evidence, stating that while it has never actually been observed by any naturalist, "the natives who know it well positively assert that a few inhabit the Caballos Mountains and some point near the south coast." While there is no intrinsic reason why it should not be found in the Isle of Pines, just as in Cuba, this can scarcely be regarded as very satisfactory evidence from a scientific standpoint. Mr. Read, however, reports a single individual as having been secured on August 26, 1909, adding that it was so badly mutilated that no effort was made to save it, and it is mainly on the strength of this record that the species is allowed to remain on the list.

66. *Geotrygon chrysia* Salvadori. KEY WEST QUAIL DOVE.

*Geotrygon martinica* (not *Columba martinica* Linnæus) CORY, Cat. W. Indian Birds, 1892, 97 (I. of Pines, in geog. distr.).

*Geotrygon chrysia* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 198 (Pasadita).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines; descr.).

"Quail Dove" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 102, and XXX, 1913, 131 (I. of Pines); XXVIII, 1911, 113 (West McKinley).

One specimen: Nueva Gerona.

This is one of the rarer birds in the Isle of Pines. Mr. Zappey took but two specimens, both at Pasadita, remarking that it occurs only on one or two of the mountains and in the dense forest south of the Cienaga. Mr. Read asserts that he has taken specimens of this species, but that it is rare. Mr. Link secured but the one specimen listed above; this was taken on July 3 in the thick jungle on the Casas Mountains, and another was seen there on December 30. The bird secured was an adult female, containing well-developed eggs. It is markedly duller than a male bird from Cuba.

67. *Geotrygon montana* (Linnæus). RUDDY QUAIL DOVE.

*Geotrygon montana* CORY, Cat. W. Indian Birds, 1892, 97 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 197 (La Vega, Pasadita, and Cayo Bonito; habits), 203, in text (Santa Sevilla).—READ, Oölogist, XXVI, 1909, 149 (I. of Pines; habits); XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines; descr.).

"Ruddy Quail Dove" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 75 (I. of Pines); XXVIII, 1911, 113 (West McKinley); XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines).

"The Ruddy Quail-dove occurs in the Isle of Pines in the denser woods only, usually in rather moist places, where the ground is often flooded after heavy rains. It is nowhere abundant. When flushed from the ground it flies but a short distance and on alighting again runs along for a few feet and conceals itself among the vegetation much after the manner of the American Woodcock (*Philohela minor*), which it curiously resembles when started in the deep woods." (Bangs & Zappey.)

Mr. Read's account agrees well with the above. Mr. Link failed to meet with this species, although he heard of it on one occasion.

68. *Chæmepelia passerina aflavida* (Palmer & Riley). CUBAN GROUND DOVE.

*Columba passerina* (not of Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Columbigallina passerina* CORY, Cat. W. Indian Birds, 1892, 97 (I. of Pines, in geog. distr.).

*Columbigallina passerina aflavida* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 197 (Cayo Bonito, El Hospital, Jucaro, and San Juan).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines; nesting).

"Ground Dove" READ, Oölogist, XXVI, 1909, 57, 58, 75 (I. of Pines).

"Cuban Ground Dove" READ, Oölogist, XXVII, 1910, 5 (Nuevas River), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley and Santa Barbara Mountain, etc.), 5 (McKinley; nesting), 6 (Nuevas River), 7 (Cañada Mountains, etc.), 113 (West McKinley), 146 (Bibijagua); XXX, 1913, 123 (Nuevas River), 125, 127 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).

"West Indian Ground Dove" READ, Oölogist, XXVII, 1910, 42 (I. of Pines; nesting).

*Chæmepelia passerina aflavida* READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—TODD, Ann. Carnegie Mus., VIII, 1913, 561 (I. of Pines; references), 599 (Jucaro, El Hospital, San Juan, Cayo Bonito, and "Nueva Gerona, etc.").

Twenty-three specimens: Bibijagua, Los Indios, and Nueva Gerona.

Several of Mr. Read's records above quoted are additional to those given by the writer under the head of this form in his late review of the present genus (ANNALS CARNEGIE MUSEUM, VIII, 1913, 561-562), while other references have been corrected. These were among the few that were not personally verified at the time.

A very common species everywhere, except, of course, in marshy country, and in dense woodland. At Caleta Grande, on the south coast, it was the only species of the family observed. It is very tame, not being subject to persecution as are the larger pigeons and doves, nor does it appear to go in flocks as do the latter. Mr. Link found two nests early in May containing eggs almost ready to hatch, while Mr. Read has recorded fresh eggs as early as January 20, and doubtless the species breeds here almost every month of the year, as elsewhere throughout its general range. Young in juvenal dress were taken in July, December, and February.

69. *Zenaida zenaida zenaida* (Bonaparte). ZENAIDA DOVE.

*Columba zenaida* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Zenaida zenaida* CORY, Cat. W. Indian Birds, 1892, 97 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).

*Zenaida zenaida zenaida* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 197 (Almácigos).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines).

"Zenaida Dove" READ, Oölogist, XXVIII, 1911, 10 (Nuevas River), 113 (West McKinley).

Ten specimens: Los Indios and McKinley.

These are indistinguishable from Bahaman specimens, although the individual variation is considerable. Females are noticeably duller than males.

The Zenaida Dove is generally distributed in the dry country north of the Cienaga, and is often found associated with the West Indian Mourning Dove, although only about half as numerous as the latter. Both kinds are shot for food during the open season. Only a few were seen about Nueva Gerona, but at Los Indios it was fairly common, occurring in good-sized flocks through the fall and early winter months. A nest supposed to belong to this species was found in the mangroves along the Los Indios River late in April.

70. *Zenaidura macroura macroura* (Linnæus). WEST INDIAN MOURNING DOVE.

*Columba carolinensis* (not of Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *fide* Gundlach).

*Zenaidura macroura* CORY, Cat. W. Indian Birds, 1892, 97 (I. of Pines, in geog. distr.).

*Zenaidura macroura bella* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 197 (Rio Santiago and El Hospital; habits).

"Mourning Dove" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines).

"West Indian Mourning Dove" READ, Oölogist, XXVII, 1910, 5 (Nuevas River), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley), 10 (Nuevas River), 113 (West McKinley), 146 (Bibijagua); XXX, 1913, 123 (McKinley and Nuevas River), 125, 127 (Santa Barbara), 130 (I. of Pines), 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).—READ, I. of Pines News, VI, Apr. 25, 1914 (Pine River).

*Zenaidura macroura macroura* READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

*Zenaidura macroura marginata* (*lapsus*) READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).

*Zenaidura carolinensis marginata* READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines, habits).

Eleven specimens: Bibijagua, Los Indios, and Bogarona.

After comparing these with a series from the eastern United States I must confess that I am not very favorably impressed with the claims of the respective forms to recognition as subspecies. The separation

is based on the average smaller size of the West Indian bird, and while this difference certainly exists, it scarcely seems so great as to demand formal recognition in nomenclature. I can discover no constant color-differences, the width of the tail-band, to which Messrs. Palmer and Riley call attention, being a variable character in birds from both localities.

"Throughout the island in the open pine woods, palmetto groves, and especially in old fields grown up to weeds, the Cuban Mourning Dove is an abundant bird. Several nests were found in low trees five or six feet from the ground" (Bangs & Zappey). Mr. Link confirms this statement, and adds that he found several nests in the mangroves along the Los Indios River late in April. In the fall and winter months the species is usually found in flocks, frequently in company with other kinds.

**71. *Columba leucocephala* Linnæus. WHITE-CROWNED PIGEON.**

*Columba leucocephala* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 96 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 197 (La Vega).—READ, Bird-Lore, XIII, 1911, 44 (McKinley).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, I. of Pines News, VI, Feb. 21, 1914 (Bird I., Sigüanea Bay).  
 "White-crowned Pigeon" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58, 75 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 3 (McKinley), 6, 10 (Nuevas River), 7 (Cañada Mountains, etc.), 113 (West McKinley); XXX, 1913, 123 (Pine River), 125, 127 (Santa Barbara; migr.), 131 (I. of Pines).  
 "White-head[ed] Pigeon" READ, Oölogist, XXVII, 1910, 5 (Nuevas River).

Seven specimens: Nueva Gerona, Los Indios, and Bogarona.

Most of the specimens secured show the same "patchy" condition of the plumage, apparently the result of irregular moult, which I have previously remarked in the case of Bahaman examples (ANNALS CARNEGIE MUSEUM, VII, 1911, 416).

This is a common species everywhere, except in the Cienaga, appearing in flocks late in February, and remaining until the last of September. Although a few stragglers may be seen through the winter months, the vast majority of the individuals withdraw at that season from their usual range, and according to native report resort to the "south coast," in great numbers. It is one of the most numerous birds of the various mountain ridges in the interior of the island during the breeding-season, which begins in May. The nest is usually built in the top of a royal palm, but along the Los Indios River the



birds were found nesting in the mangroves, rather low down. Mr. Read says that it was nesting abundantly in the mangroves on Bird Island in Siguanea Bay at the time of his visit, but Mr. Link failed to find it there in 1912-13. This pigeon is far shyder than the other kinds, with which it seldom associates, preferring as it does thicker covert. It is very fond of the fruit of the "cocoa-plum" (*Chrysobalanus Icacó*).

**72. *Columba squamosa* Bonnaterre. SCALY-NAPE PIGEON.**

*Columba squamosa* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 197 (Nueva Gerona, *vide* Palmer and Riley).—READ, Oölogist, XXVIII, 1911, 13, and XXX, 1913, 131 (I. of Pines), 125, 127 (Santa Barbara; migr.; local range).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines, local).

(?) "El Bobo Pigeon" READ, Oölogist, XXVIII, 1911, 3 (Santa Barbara Mountain, etc.).

While this species is reported to be still rather common in Cuba, it is now rare in the Isle of Pines, having been almost exterminated in recent years. Indeed, Mr. Link failed to meet with it at all, nor did Messrs. Palmer and Riley actually see any individuals, although they heard a few. Mr. Read tells us that although it was formerly abundant all over the island, it is now rare and local, being found only at certain points on the west and south coasts. This scarcity has been brought about solely by shooting for food and sport, which bids fair to exterminate, sooner or later, all of the larger pigeons and doves in the island, unless some means can be found to curtail the practice before it is too late.

**73. *Columba inornata proxima* Todd, subsp. nov. ISLE OF PINES PLAIN PIGEON.**

*Columba inornata* (not of Vigors) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 97 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 196 (I. of Pines; Poey's record).—READ, Oölogist, XXVI, 1909, 224, and XXVIII, 1911, 11 (I. of Pines); XXVII, 1910, 5, and XXVIII, 1911, 6, 10 (Nuevas River); XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 5 (McKinley; nesting). 7 (Cañada Mountains, etc.), 114 (West McKinley).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, Oölogist, XXX, 1913, 123 (Nuevas River), 127 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).—READ, I. of Pines News, VI, Feb. 21, 1914 (I. of Pines).

*Chlorænas inornata* GUNDLACH, Journ. für Orn., 1861, 416 (I. of Pines).—GUNDLACH, Repert. Fis.-Nat. I. Cuba, I, 1866, 29 (Santa Fé).—GUNDLACH, An. Soc. Esp. Hist. Nat. Madrid, II, 1873, 143 (Santa Fé).—GUNDLACH, Contr. Orn.

Cubana, 1876, 128 (I. of Pines).—GUNDLACH, Orn. Cubana, 1895, 155 (I. of Pines).

(?) *Zenaida zenaida (lapsus)* READ, Oölogist, XXVI, 1909, 148 (I. of Pines).

(?) "Zenaida Dove" (*lapsus*) READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines).

*Columba inornata proxima* TODD, Proc. Biol. Soc. Washington, XXVIII, 1915, 170 (Los Indios; orig. descr.).

Thirteen specimens: Los Indios.

*Type*, No. 39,892, Collection Carnegie Museum, adult male; Los Indios, Isle of Pines, December 13, 1912; Gustav A. Link.

*Subspecific characters*.—Differs from typical *inornata* of Cuba in its decidedly paler, grayer coloration, especially marked in the much less strongly vinaceous shade of the under surface. The white edgings of the median and greater wing-coverts are narrower.

Through the courtesy of the authorities of several different institutions I have been able to bring together a small series of this fast disappearing species, representing all the various islands included in its range. Even in this small series geographical variation is evident, each island apparently possessing a separate form with the exception of Haiti, the single bird from which is indistinguishable from Cuban examples. The Isle of Pines race is easily distinguished from the typical Cuban form by the characters above specified. It is of course conceivable that these characters may be shared by birds from western Cuba, a circumstance which might possibly affect the validity of the name here proposed. The Porto Rican form, to which Mr. Ridgway has recently applied the name *exsul* (*Proceedings Biological Society of Washington*, XXVIII, 1915, 106), is much deeper in general coloration, while the Jamaican bird is extreme in this respect.

The males in the Isle of Pines series, besides being slightly larger, average more "solid" vinaceous below than the females, while the vinaceous area on the wing-coverts is also deeper and larger. September specimens are in postnuptial moult. "Iris white; feet pink."

All of the earlier authorities on the birds of Cuba and the Isle of Pines agree as to the abundance of the Plain Pigeon in both islands, but of late years its numbers have become very much reduced in Cuba, and according to the statements of several reliable observers it is practically extinct in many parts of that island. In the Isle of Pines, however, it is still common locally, but, with the persecution to which it is being subjected by the inhabitants, it will be a question of only a few years before it will be as rare here as in Cuba. The

open season for shooting lasts from September until the end of April, and thus extends well into the breeding-season. Moreover, the birds are so easily shot that large bags are the rule. In the spring and fall months they are found in flocks of greater or less extent, scattered through the pine-lands, feeding on the fruit of the "cocoa-plum." At such times they may be approached with ease, paying little attention to an intruder, even after being repeatedly fired at, whence their common name of "El Bobo" (fool) Pigeon.<sup>15</sup> Many such flocks were seen at Los Indios for about a week during the latter part of September, after which they disappeared, and only a few odd birds were seen until the end of March, when the flocks began to appear, seeming to come from the south. The natives say that they retire to the "south coast" for the winter months, but this could not be verified. That there is a limited migration in both *Columba leucocephala* and the present species, however, is beyond question. In other sections of the island it is evidently not so common, Mr. Zappey having secured but a single specimen on his first trip, and none at all in 1904. Mr. Read speaks of finding a nest on April 29, 1910, built in a blown-over tree about twenty feet from the ground, and composed of a few loose sticks, like that of the Mourning Dove. This nest had eggs on May 4

#### 74. *Ara tricolor* (Bechstein). CUBAN MACAW.

*Ara tricolor* CORY, Cat. W. Indian Birds, 1892, 101, 127 (I. of Pines).—GUNDLACH, Orn. Cubana, 1895, 151 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 200 (La Vega).—CLARK, Auk, XXII, 1905, 348 (I. of Pines, in geog. distr.).—ROTHSCHILD, Extinct Birds, 1907, 51 (I. of Pines, in geog. distr.; Bangs and Zappey's record).

The Cuban or Great Antillean Macaw, the range of which at one time included not only Cuba and the Isle of Pines, but also Haiti and Jamaica, has been extinct for many years, having been destroyed by the inhabitants because of its value for food. Gundlach attributes it to the Isle of Pines, and Messrs. Bangs and Zappey remark as follows: "It has been supposed that perhaps the Cuban Macaw still lingered in the Isle of Pines. Unfortunately this is not so. The last pair known in the island was shot at La Vega, near the Cienaga, about the year 1864, and none have been seen since. This information was

<sup>15</sup> Mr. Read claims that this name properly belongs to *Columba squamosa*, but Gundlach applies it to the present species, and Mr. Link indorses this procedure. Mr. Reed seems to have confused one or both of these pigeons with the Zenaida Dove during the early part of his work.

furnished by the man on whose plantation they were shot." The fate which has befallen this and other West Indian parrots bids fair to overtake additional species of this family.

**75. *Aratinga euops* (Wagler). CUBAN PAROQUET.**

*Conurus guianensis* (not *Psittacus guianensis* Gmelin) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Conurus euops* GUNDLACH, Contr. Orn. Cubana, 1876, 126 (I. of Pines).—CORY, Cat. W. Indian Birds, 1892, 101 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1893, 152 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 200 (I. of Pines).—CLARK, Auk, XXII, 1905, 310 (I. of Pines, in geog. distr.).

Gundlach, writing some twenty years ago, says that the Cuban Paroquet was formerly very abundant in the Isle of Pines, but at the rate it was being taken for the cage-bird traffic it would be merely a question of a few years more before it would be entirely exterminated. Hundreds of young birds were being exported every year, it seems. This prediction has been fulfilled, for neither Mr. Zappey nor Mr. Link met with the species during their respective visits to the island, nor did they even hear any reports of its occurrence. The outcome in this case will inevitably be that of other species in this family also, unless the traffic in living birds can in some way be stopped.

**76. *Amazona leucocephala palmarum* subsp. nov. ISLE OF PINES PARROT.**

*Psittacus leucocephalus* (not of Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Chrysotis leucocephalus* GUNDLACH, Contr. Orn. Cubana, 1876, 124 (I. of Pines?).—GUNDLACH, Auk, VIII, 1891, 189, in text (I. of Pines; plumage).—GUNDLACH, Orn. Cubana, 1893, 149 (I. of Pines).

*Amazona leucocephala* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 201 (Pasadita and El Hospital; nesting).—READ, Oölogist, XXVIII, 1911, 11 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

"Green Parrot" READ, Oölogist, XXVI, 1909, 58 (I. of Pines).

"Cuban Green Parrot" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXX, 1913, 127 (Santa Barbara), 168 (Los Indios).

"Cuban Parrot" READ, Oölogist, XXVII, 1910, 5 (Nuevas River); XXVIII, 1911, 5 (McKinley; nesting), 6, 10 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (McKinley and Nuevas River), 125, 129, pl. (Santa Barbara; nesting), 130 (I. of Pines).

Twenty-four specimens: Bibijagua and Los Indios.

*Type*, No. 39,630, Collection Carnegie Museum, adult female; Los Indios, Isle of Pines, October 9, 1912; Gustav A. Link.

*Subspecific characters*.—Similar to *Amazona leucocephala leucocephala*

(Linnæus), but general color darker green; the abdominal purplish red patch averaging darker and more extensive; and the throat somewhat deeper red.

*Measurements*.—Male (ten specimens): wing, 190–196 (average, 194); tail, 110–122 (116); exposed culmen, 25–28 (26.6); depth of bill, 28–31 (29). Female (ten specimens): wing, 184–194 (187); tail, 102–119 (113.5); exposed culmen, 25–27 (26); depth of bill, 27–29 (27.6).

With a series of twenty-four specimens of the Isle of Pines *Amazona leucocephala* before me I find that they differ sufficiently from the average Cuban bird to bear formal separation. While it is true that there is considerable variation in the extent of the abdominal purplish red patch in both series (possibly dependent on age), the average difference between the two series in this respect is fairly well marked, and taken in connection with the other characters above mentioned is in my judgment sufficient to justify the recognition of the form from the Isle of Pines as distinct. Save that the latter seems to have a slightly longer tail, there is apparently no especial difference in size, so far at least as indicated by the series examined in this connection.

Numerous individuals in the present fine series show scattered green feathers on the throat and sides of the head, while in others the crown feathers along the posterior line of the white frontal patch are stained with yellow or crimson. A specimen shot July 6 is evidently a young bird in full moult, judging from its small size, differently colored bill, restricted white front, and small amount of red on the rectrices. Another taken September 21 is a very pale bird, in which the tertials are narrowly tipped with crimson, and the abdominal purplish red patch very extensive.

Judging from reports of the relative numbers annually exported, this parrot is more numerous at the present time in the Isle of Pines than is its relative in Cuba. One dealer in live birds was shipping about twenty-one hundred young parrots from the Isle of Pines in July, 1912, but in all Cuba had been able to secure only about a thousand birds for this purpose. According to his testimony, they were formerly much more abundant than at present, and of course will continue to decrease indefinitely unless this practice can be checked. So important had the business of trapping parrots become at one time that there grew up in many parts of the island a system of "parrot lines," to define the hunting rights of different individuals,



and these lines frequently figure in present-day boundary disputes. The parrot-hunters keep taking the young birds at every opportunity, and make a practice of removing the eggs or young of distant nests to nests of other pairs which chance to be nearer their own homes, so as to keep rival hunters from eventually securing them. Three or four eggs constitute the usual complement, but often a pair of birds is compelled to rear twice as many young for the sole benefit of the parrot-hunters. The nests are invariably built in an old woodpecker's hole in a bottle-palm, usually only fifteen or twenty feet from the ground, and the eggs are pure white. Mr. Link's first nest was found early in April, and on April 15 a set of three eggs was secured. Mr. Read records a nest still containing young as late as June 27. Parrots are fairly common throughout the drier parts of the island (except in the mountains), affecting the groves of pine and bottle-palms (Pl. XXIII, fig. 3). They feed on the cones and tender shoots of the pines, as well as on the seeds of the royal palm, and it is said that they also damage the cultivated grape-fruit, on which account they are considered a nuisance, and many are shot. Except in the nesting-season, they are found in large flocks, and are at all times very noisy and unsuspicious. The bulk of the individuals seem to disappear in September, however, and only a few odd birds are to be seen until the latter part of January. The natives say that during this interim they retire to the "south coast," like the pigeons, but this statement could not be confirmed.

**77. *Crotophaga ani* Linnæus. ANI.**

*Crotophaga ani* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 102 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 200 (Cayo Bonito, Santa Fé, and Jucaro; habits).—READ, Oölogist, XXVI, 1909, 102 (I. of Pines; habits); XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

"Black Parrot" READ, Oölogist, XXVI, 1909, 58 (I. of Pines), 102 (crit.).

"Ani" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 223 (I. of Pines); XXVII, 1910, 5, and XXVIII, 1911, 6, 10 (Nuevas River), 3 (McKinley), 113 (West McKinley); XXX, 1913, 123 (McKinley and Nuevas River), 125 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).

Thirteen specimens: Nueva Gerona and Los Indios.

These are precisely like specimens from other West Indian localities. There is one bird in juvenal dress, dated June 29.

The Ani was not detected in the Cienaga or in the country to the southward, but to the northward it is a very common and generally distributed species. It prefers the more open country, and is eminently gregarious in its habits, often being seen in pastures attending the cattle and other stock. Like the Caracara and some other birds, it is fond of following in the wake of brush-fires, picking up the roasted lizards, snails, and insects. On several occasions flocks were found roosting in the mangroves along the Los Indios River, attracting attention by their habit of huddling close together on the perch, like domestic fowls.

78. **Saurothera decolor** Bangs & Zappey. ISLE OF PINES LIZARD CUCKOO.

*Saurothera merlini* (not of D'Orbigny) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Saurothera merlini decolor* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 199 (La Vega, Cayo Bonito, and El Hospital; orig. descr.; type now in Mus. Comp. Zool.; habits; crit.).—ALLEN, Auk, XXII, 1905, 329, in text (review).—EDITORS, Ibis, 1905, 631, in text (review).—READ, Oölogist, XXVI, 1909, 190 (I. of Pines), 223 (I. of Pines; descr.; habits); XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, I. of Pines News, VI, Nov. 22, 1913 (I. of Pines; habits).

"Lizard Cuckoo" READ, Oölogist, XXVII, 1910, 84 (McKinley to Nueva Gerona). "Isle of Pines Lizard Cuckoo" READ, Oölogist, XXVIII, 1911, 5 (Santa Barbara Mountain, etc.), 6, 10 (Nuevas River), 7 (Cañada Mountains, etc.), 114 (West McKinley); XXX, 1913, 123 (Nuevas River), 125, 130 (Santa Barbara), 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).

Twenty-one specimens: Nueva Gerona, Bibijagua, and Los Indios.

This is a very distinct form, differing so markedly from *S. merlini* of Cuba that I venture to raise it to the rank of a species. As stated in the original description, it seems in fact to be rather nearer to *S. bahamensis* in general coloration, resembling *S. merlini*, however, in having the primaries rufous. The series of adults is very uniform as a whole, the size and shape of the black markings on the tail being perhaps the most variable character. A number of young birds, distinguished by their duller and paler coloration, and by the lack of a subterminal black bar on the rectrices, were taken between June 28 and July 3.

Poeý appears to have been the only author to record a *Saurothera* from the Isle of Pines previous to Messrs. Bangs and Zappey, whose specimens proved to belong to a form quite different from that of Cuba. With reference to its habits, they state that it is "a common

bird in rough, rocky country, wherever there is a thick growth of scrub and bushes, and is very tame. It has a habit of hopping from one branch to another till it reaches the top of a bush and then sailing down to the ground or the lower branches of another bush. Its usual call-note is a sort of laugh that begins low and slowly, and rapidly ascending, ends in a low chuckle. When two individuals are within sight of each other they often go through a curious performance, which consists in lowering the head and dropping the feathers of the throat which then looks like a large pouch, at the same time spreading the wings and tail to their fullest extent and repeating the loud chuckling notes that end the usual call. The stomachs of those taken contained the remains of small lizards, beetles, caterpillars, and large moths." It is a common species everywhere in the island, except in the Cienaga.

**Coccyzus americanus** (Linnæus). YELLOW-BILLED CUCKOO.

(?) "West Indian Yellow-billed Cuckoo" READ, *Oölogist*, XXVIII, 1911, 13 (I. of Pines), 114 (West McKinley); XXX, 1913, 131 (I. of Pines).

This is the only species of this genus known to regularly visit Cuba, so that it is presumably this form which is meant by Mr. Read under the above caption. He speaks of having seen individuals on April 29, 1910, and March 3, 1911, but, as some doubt attaches to the identification, the records are open to question.

**Coccyzus erythrophthalmus** (Wilson). BLACK-BILLED CUCKOO.

(?) *Coccyzus erythrophthalmus* READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

(?) "Black-billed Cuckoo" READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines).—READ, *Oölogist*, XXVI, 1909, 102, and XXX, 1913, 131 (I. of Pines); XXVIII, 1911, 114 (West McKinley).

This species, migrating as it does through Mexico and Central America, is of merely accidental occurrence in Cuba, and unknown in the other Antilles. Mr. Read's records, above cited, refer to individuals noted on May 11, 1909, and in November, 1910, respectively. In reply to an inquiry he writes that the first one was actually secured, but as the specimen is unfortunately not now extant, and there is no way of confirming the record otherwise, it is deemed unwise to admit it under the circumstances.

## 79. *Glaucidium siju vittatum* Ridgway. ISLE OF PINES PYGMY OWL.

*Noctua siju* (not of D'Orbigny) POEY, *Mem. Hist. Nat. Cuba*, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Glaucidium siju* CORY, *Cat. W. Indian Birds*, 1892, 100 (I. of Pines, in geog. distr.).

—BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 202 (Santa Fé and Cayo Bonito; habits).—READ, *Oölogist*, XXVI, 1909, 190; XXVII, 1910, 35 (I. of Pines; descr.; habits); XXVIII, 1911, 11 (I. of Pines).—READ, *Bird-Lore*, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, *Oölogist*, XXX, 1913, 122 (McKinley; habits).—READ, *I. of Pines News*, VI, Jan. 24, 1914 (descr.; habits).

"Cuban Pygmy Owl" READ, *Oölogist*, XXVII, 1910, 5, and XXVIII, 1911, 10 (Nuevas River), 5 (Santa Barbara Mountain), 7 (Cañada Mountains, etc.), 113 (West McKinley); XXX, 1913, 123 (Nuevas River), 125 (Santa Barbara), 130 (I. of Pines).

*Glaucidium siju vittatum* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 805 (Nueva Gerona; orig. descr.; type in coll. U. S. Nat. Mus.).

Eighteen specimens: Nueva Gerona, Bibijagua, and Los Indios.

Messrs. Bangs and Zappey could discover no particular difference between specimens of *Glaucidium siju* from Cuba and the Isle of Pines respectively, and it remained for Mr. Ridgway to distinguish the form from the latter island. Judging from the series brought back by Mr. Link, which I have had the opportunity of comparing with another series from various parts of Cuba, it is a well-marked geographic race, differing not only in its somewhat larger size, but also in its more grayish, less rufescent coloration, both above and below. There is some variation, it is true, of an apparently individual character, affecting the exact pattern of the markings of the under parts, which in some specimens tend to arrange themselves in bars, and in others partake more of the nature of streaks. Only one of the Cuban specimens before me is as gray above as the average Isle of Pines bird, and while half of the Cuban series are in the rufescent phase described by Mr. Ridgway, not a single specimen of the Isle of Pines series shows any approach to that condition of plumage.

This little owl is common and generally distributed in the Isle of Pines, and is one of the first birds to attract the attention of a newcomer, coming boldly as it does into gardens and the vicinity of houses, and showing little fear of man. It appears to feed mainly on grasshoppers, beetles, and lizards, although from the treatment it receives from small birds it is evident that these also enter to some extent into its bill of fare. Indeed, Mr. Read records a case in which one of these owls even attacked and killed a Cuban Meadowlark—a species larger than itself—only to be in its turn attacked and driven off by a half-dozen of the latter. In habits it is more diurnal than nocturnal, and its call, described by Mr. Read as a series of shrill, sharp, short whistles, high-pitched at first, and gradually descending the scale, is apt to be heard at any time of the day or night. It has a peculiar habit of nervously twitching its tail, sometimes even holding it erect, wren-fashion. Nothing appears to be on record concerning its nesting in the Isle of Pines, but Gundlach says that the Cuban

bird is wont to use the old holes of woodpeckers in palm-trees for this purpose, laying its eggs in March and April.

80. *Gymnasio lawrencii exsul* Bangs. ISLE OF PINES BARE-LEGGED OWL.

*Noctua nudipes* (not *Strix nudipes* Daudin) POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *fide* Gundlach).

*Gymnasio lawrencii* CORY, Cat. W. Indian Birds, 1892, 100 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 35 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 202 (Pasadita and Santa Sevilla; habits; crit.).—READ, Oölogist, XXVIII, 1911, 13 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 679 (Pasadita and Santa Sevilla; meas.).—READ, I. of Pines News, VI, Jan. 24, 1914 (I. of Pines; descr.).—READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

*Gymnasio lawrencii exsul* BANGS, Proc. New England Zoölogical Club, IV, 1913, 91 (Santa Sevilla; orig. descr.; type now in coll. Mus. Comp. Zoöl.; meas.; crit.).—STONE, Auk, XXX, 1913, 453, in text (review).

Two specimens: Nueva Gerona.

Besides the above, I have before me two of the birds collected by Mr. Zappey, and the type-specimen of *Gymnoglaux lawrencii* Sclater and Salvin (No. 39,111, Collection U. S. National Museum; Remedios, Cuba, October 30, 1863; N. H. Bishop), as well as six other specimens from Cuba, kindly loaned by Messrs. Bangs and Ramsden. There is some variation in both series, but the general differences between the two, pointed out by Mr. Bangs, are obvious at a glance. The specimens from eastern and central Cuba are much more rufescent both above and below than those from the Isle of Pines, while the white spotting on the back and wings, as well as the light barring on the tail, is much less pronounced. There is no especial difference in size, however. A skin from San Francisco de Morales, in western Cuba, agrees better with the Isle of Pines birds than with those from eastern Cuba, so that it is probable that this is the form inhabiting the entire western part of the island. Although Mr. Ridgway sinks *exsul* as a synonym of *lawrencii*, and it is of course possible that with a larger series the characters relied on for their discrimination might break down, or prove to have no especial geographical significance, I have no other alternative than to recognize it for the present.

This species is rare in the Isle of Pines, but being strictly nocturnal, this rarity may be more apparent than real. Mr. Zappey secured three specimens in all, at Pasadita and Santa Sevilla, finding a brood of three half-grown young at the latter locality, the nest being in a hole in a



tree. The pair of birds brought back by Mr. Link were taken in a small cave on the slope of the Caballos Mountains near Nueva Gerona on February 15. The female showed no signs of breeding at this date.

81. *Asio stygius* (Wagler). STYGIAN OWL.

*Asio stygius* CORY, Cat. W. Indian Birds, 1892, 100 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1893, 33 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 658 (La Vega, in geog. distr.; crit.).

*Nyctalops stygius signapa* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 201 (La Vega; crit.; ex *Otus signapa* D'Orbigny).—READ, I. of Pines News, VI, Jan. 24, 1914 (I. of Pines, rare).

One specimen: Pasadita.

This is a rare bird in the Isle of Pines, and does not appear to be much, if at all, more numerous in Cuba. Mr. Zappey, who was fortunate enough to secure a fine adult male at La Vega on May 25, 1904, reports that it is found only in the heaviest and densest forests, and because of its strictly nocturnal habits it is extremely hard to obtain. Mr. Link secured a single young bird on May 28, at Pasadita. This specimen, being in moult from the downy stage, is useless for comparison, but Messrs. Bangs and Zappey say that their specimen differs from continental examples in being much paler, and they accordingly adopt D'Orbigny's name, based on the Cuban bird, as the proper subspecific appellation of the supposed form. But Mr. Ridgway, while admitting the peculiarities of their Isle of Pines specimen, finds himself unable to satisfactorily divide the species on this basis, and it seems a safer course to follow this conclusion for the present.

82. *Tyto perlata furcata* (Temminck). WHITE-WINGED BARN OWL.

*Strix furcata* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *fide* Gundlach).

*Strix pratincola furcata* CORY, Cat. W. Indian Birds, 1892, 100 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 202 (Santa Sevilla; food).—READ, I. of Pines News, VI, Jan. 24, 1914 (I. of Pines; habits).

"Cuban Barn Owl" READ, Oölogist, XXVIII, 1911, 13, and XXX, 1913, 125 (Santa Barbara), 130 (I. of Pines), 164 (Santa Barbara to Nueva Gerona).

*Tyto perlata furcata* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 602 (Santa Sevilla, in geog. distr.; meas.).

Six specimens: McKinley, Nueva Gerona, Los Indios, and Pasadita.

Two of these six skins are very pale above as compared with the others, while the amount of spotting below also varies to some extent. Only one individual shows any dark marking on the tail, and this is

confined to some brown shaft-spots, and fine mottling at the tips of some of the feathers.

Poey recorded this species many years ago from the Isle of Pines, and Mr. Read also has occasionally observed it, a specimen collected by him at McKinley being now in the collection of the Carnegie Museum. The five fine specimens sent in by Mr. Link were secured in every case during moonlight nights, in the vicinity of poultry-houses, where these owls often come in search of their prey. On such occasions they are readily attracted by making any kind of a squeaking noise, when they come up and circle about overhead, presenting a fair shot. They seem to be strictly nocturnal, and for this reason they are seldom observed, and may be far more common than is apparent. Mr. Read says that they are accustomed to spend the day in the thick tops of the bottle-palms, and adds that they are often attracted in the night-time by the brilliant headlights of an automobile, and fly down in front of the machine. The stomachs of all the individuals examined contained feathers, whence it is evident that small birds constitute a larger proportion of the food of this species than in the case of the Barn Owl of continental North America, which feeds so largely on small mammals. The single example shot by Mr. Zappey had been eating a Ruddy Quail Dove. Nothing appears to be on record concerning its nesting habits, so far as the Isle of Pines is concerned.

83. *Chordeiles virginianus virginianus* (Gmelin). NIGHTHAWK.

*Chordeiles virginianus virginianus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 203 (Santa Fé; meas.).—OBERHOLSER, Bull. U. S. Nat. Mus., No. 86, 1914, 517 (Santa Fé; crit.).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 562 (Santa Fé, in geog. distr.).

The only positive record for the typical form of the Nighthawk from the Isle of Pines appears to be that above quoted, which refers to a single specimen shot by Mr. Zappey at Santa Fé on May 10, 1904, and which proved to be exactly like examples from New England. Gundlach says that it occurs regularly in Cuba during migration, in October and May, so that it is doubtless a regular migrant in the Isle of Pines also, but may often have been confused with the smaller resident form.

84. *Chordeiles virginianus minor* (Cabanis). CUBAN NIGHTHAWK.  
(Plate XXVI.)

*Chordeiles minor* CORY, Cat. W. Indian Birds, 1892, 105 (I. of Pines, in geog. distr.).

—GUNDLACH, Orn. Cubana, 1895, 101 (I. of Pines).

*Chordeiles virginianus minor* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 203 (Los Almacigos, Santa Fé, and El Hospital; plum.; habits).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, I. of Pines News, VI, Jan. 3, 1914 (habits).—OBERHOLSER, Bull. U. S. Nat. Mus., No. 86, 1914, 82 (Nueva Gerona, El Hospital, and Los Almacigos; meas.; crit.).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 576 (I. of Pines, in geog. distr.).

"Nighthawk" READ, Forest and Stream, LXXIII, 1909, 75 (I. of Pines).—READ, Oölogist, XXVI, 1909, 75 (I. of Pines).

"Antillean Nighthawk" READ, Oölogist, XXVIII, 1911, 7 (I. of Pines; migr.), 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 124 (Pine River), 125 (Santa Barbara; migr.), 168 (Los Indios).

"Cuban Nighthawk" READ, Oölogist, XXX, 1913, 131 (I. of Pines, summer; migr.).

"West Indian Nighthawk" READ, Oölogist, XXX, 1913, 159-162, 4 pls. (Santa Barbara; figs. nest and eggs).

Three specimens: Bibijagua, McKinley, and Los Indios.

This is the race of *Chordeiles virginianus* which is a summer resident in the Greater Antilles. It may readily be distinguished by its small size, and is furthermore peculiar in having a rufescent phase of plumage entirely independent of age, sex, or season. In the present series there is one female in this rufescent phase, and another more grayish, also one male in the gray phase. The significance of this dichromatism is no more understood than in other cases in which it occurs. Mr. Oberholser has given reasons for believing that *C. v. minor* is probably the nearest living representative of the "original-stock" form, and it is certainly a very strongly marked subspecies, if not indeed worthy of higher rank.

A very common bird in the Isle of Pines, the generally open character of much of the country being very well suited to its needs. In its habits it closely resembles the northern form, flying mostly in the morning and evening in dry weather, but throughout the day during rainy weather, at which times scores may be in sight at once. It is a summer resident only, but arrives very early, Mr. Link's first specimen having been taken February 6, while Mr. Read recorded it in 1912 on March 14. It lays its eggs on the ground in open situations, and the young are hatched in May. Plate XXVI shows the incubating bird, and is reproduced from a photograph made by Mr. Read, a cut pre-

pared from which has been kindly loaned by Mr. R. M. Barnes, the editor of *The Oölogist*. None were seen after the last of September. Its winter home appears to be still unknown.

85. **Setochalcis cubanensis** (Lawrence). CUBAN WHIP-POOR-WILL.

*Caprimulgus vociferus?* (not of Wilson) POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Antrostomus vociferus?* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 203 (I. of Pines, *ex* Poey; *crit.*).

*Antrostomus cubanensis* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 203 (Cienaga).—READ, Oölogist, XXVII, 1911, 12 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 513 (I. of Pines, in geog. distr.).

"Whip-poor-will" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 124 (I. of Pines); XXVIII, 1911, 113 (West McKinley).

"Cuban Whip-poor-will" READ, Oölogist, XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines).

Inasmuch as the common Whip-poor-will is unknown in the West Indies (except for a single accidental occurrence in Porto Rico), it is practically certain that Poey's record above quoted refers to the present species, which otherwise is known only from Cuba, and seems to be rare in collections. Mr. Zappey shot a single bird in June, in the dense woods south of the Cienaga, but unfortunately it was too much mangled to be preserved. Mr. Link did not meet with this species, but Mr. Read says that he has noted it on a few occasions in the northwestern part of the island, and writes that he has even found it nesting there.

86. **Antrostomus carolinensis** (Gmelin). CHUCK-WILL'S-WIDOW.

*Antrostomus carolinensis* CORY, Cat. W. Indian Birds, 1892, 105 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 103 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 506 (I. of Pines, in geog. distr.).

According to Gundlach, the present species is not rare in Cuba, occurring every year, presumably as a winter resident. He attributes it also to the Isle of Pines without special comment, this being the only record so far available. It should be looked for in suitable covert at the proper season.

87. **Todus multicolor** Gould. CUBAN TODY.

*Todus portoricensis* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Todus multicolor* CORY, Cat. W. Indian Birds, 1892, 103 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 201 (Santa Fé and Cayo Bonito;

habits).—READ, *Oölogist*, XXVI, 1909, 190 (I. of Pines); XXVII, 1910, 62 (I. of Pines; descr.; habits); XXVIII, 1911, 13 (I. of Pines); XXX, 1913, 123 (McKinley).—READ, *Bird-Lore*, XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, *I. of Pines News*, V, Nov. 7, 1913 (descr.; habits).—RIDGWAY, *Bull. U. S. Nat. Mus.*, No. 50, VI, 1914, 443 (Nueva Gerona, Cayo Bonito, and Santa Fé; meas.).

"Cuban Tody" READ, *Oölogist*, XXVIII, 1911, 5 (Santa Barbara Mountain, etc.); XXX, 1913, 125, 127 (Santa Barbara), 130 (I. of Pines).

Eighteen specimens: Nueva Gerona and Los Indios.

Compared with a small series from Cuba, the Isle of Pines birds differ only in having the sides of the neck rather deeper blue, but the difference is slight and not entirely constant. There is some individual variation observable in the color of the breast, which in some individuals is tinged with pink.

This brilliant little bird is an inhabitant of the thickets, and is very common in such situations throughout the island, being particularly numerous on the mountain slopes. It feeds on insects, darting out after them like a flycatcher, the wings making a buzzing sound like a hummingbird's. Its call-note is a rattling sound likened by Messrs. Bangs and Zappey to that made by striking two small pebbles together. It is the reverse of shy, manifesting much curiosity over an intruder into its haunts, and sometimes following for a little distance. It seems to have a special antipathy towards the Ricord Hummingbird, driving it off at every opportunity. Mr. Link did not succeed in finding any nests.

# 88. *Streptoceryle alcyon alcyon* (Linnæus). BELTED KINGFISHER.

*Alcedo alcyon* POEY, *Mem. Hist. Nat. Cuba*, 1854, 427 (Nueva Gerona, *fide* Gundlach).

*Ceryle alcyon* BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 201 (I. of Pines, winter).

—READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

"Belted Kingfisher" READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines).

—READ, *Oölogist*, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River); XXVIII, 1911, 7 (I. of Pines; migr.), 113 (West McKinley); XXX, 1913, 125, 127 (Santa Barbara), 130 (I. of Pines).

Two specimens: Los Indios and Nueva Gerona.

A winter resident, fairly common along the rivers, but not seen along the coast. A few were noted also in the Cienaga, near Sigüanea. It arrives from the north in September, the earliest date recorded by Mr. Read being September 12, 1913. It was observed at Los Indios as late as the first half of April.



89. **Sphyrapicus varius varius** (Linnæus). YELLOW-BELLIED WOOD-PECKER.

*Picus varius* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Sphyrapicus varius* CORY, Cat. W. Indian Birds, 1892, 104 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 139 (I. of Pines).

*Sphyrapicus varius varius* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 206 (I. of Pines; PoeY's record).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 274 (I. of Pines, in geog. distr.).

PoeY lists this species among those observed by Gundlach near Nueva Gerona, and it is also given by Gundlach himself from the Isle of Pines. It is a regular winter visitant to Cuba. Mr. Zappey saw a few in March, 1902, but none were noted on his later trip. Neither Mr. Link nor Mr. Read appear to have met with it, so that it cannot be a very common or regular visitant to the Isle of Pines.

90. **Xiphidiopicus percussus insulæ-pinorum** Bangs. ISLE OF PINES GREEN WOODPECKER.

*Picus percussus* (not of Temminck) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Xiphidiopicus percussus* CORY, Cat. W. Indian Birds, 1892, 104 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 140 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 206 (Santa Fé, Cayo Bonito, and Jucaro).—READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 124, and XXVIII, 1911, 12 (I. of Pines).—READ, I. of Pines News, VI, Jan. 17, 1914 (descr.; habits).

"Cuban Green Woodpecker" READ, Oölogist, XXVII, 1910, 5, and XXVIII, 1911, 6, 10 (Nuevas River), 3 (McKinley), 5 (Santa Barbara Mountain, etc.); XXX, 1913, 125, 127 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).

*Xiphidiopicus percussus insulæ-pinorum* BANGS, Proc. Biol. Soc. Washington, XXIII, 1910, 173 (Santa Fé; orig. descr.; type now in coll. Mus. Comp. Zoöl.; meas.).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 185 (Nueva Gerona, Santa Fé, Jucaro, and Cayo Bonito, *ex* Bangs & Zappey; diag.).

Twenty-nine specimens: Nueva Gerona and Los Indios.

Not all of the alleged differences pointed out by Mr. Bangs appear to hold good upon comparison, but the smaller size, more restricted red throat-patch, and generally narrower streaking of the under parts are excellent diagnostic characters of this very distinct insular subspecies. Moreover, the median throat-stripe is wholly black, while in the specimens of true *percussus* examined it is tinged with red almost to the chin. The extent of the streaking on the under surface is a

variable character, as is also the width of the median black throat-band. Females would seem on an average to have the outer rectrices more decidedly barred than males. Two females in juvenal dress, taken on May 3 and June 28 respectively, have the feathers of the pileum (except anteriorly) tipped with red, as in the adult male. The crimson patch on the breast is lacking, and the general coloration duller, but otherwise they are like adults.

Although by no means so abundant as the other native woodpecker, the present species is nevertheless a common bird, preferring the depths of the jungle, however, to the palm-groves. Its call-note is not unlike that of the Yellow-bellied species. It is a much less noisy bird than the *Centurus*, and thus is more apt to escape observation. The natives accuse it of injuring fruit in the same manner as the other species, but it is very doubtful if the charge is justified, since it is not accustomed to frequent the orange and grape-fruit groves to any great extent. Two nests were discovered, one at Los Indios, the other at Sigüanea. Both were excavated in mangroves, and contained young at the time (April and May). Mr. Read, however, says that it usually nests in the pines at the very edge of the jungle.

91. *Centurus superciliaris murceus* BANGS. ISLE OF PINES WOOD-PECKER.

*Colaptes superciliaris* (not *Picus superciliaris* Temminck) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Centurus superciliaris* GUNDLACH, Orn. Cubana, 1895, 141 (I. of Pines).—READ, Oölogist, XXVI, 1909, 102 (I. of Pines; syn.); XXVIII, 1911, 12 (I. of Pines).—READ, I. of Pines News, VI, Nov. 29, 1913 (descr.; habits).

*Melanerpes superciliaris* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 206 (San Juan, Jucaro, Nueva Gerona, and Los Almacigos; plum.; meas.; crit.).

"Red-bellied Woodpecker" READ, Oölogist, XXVI, 1909, 58 (I. of Pines).

"Cuban Red-bellied Woodpecker" READ, Forest and Stream, LXXXIII, 1909, 445 (I. of Pines).—READ, Oölogist, XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley and Santa Barbara Mountain), 5 (McKinley; nesting), 6, 10 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (Nuevas River), 125, 127 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).

*Centurus superciliaris murceus* BANGS, Proc. Biol. Soc. Washington, XXII, 1910, 173 (San Juan; orig. descr.; type now in coll. Mus. Comp. Zoöl.; meas.).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, VI, 1914, 61 (Nueva Gerona, Santa Fé (?), San Juan, Jucaro, and Los Almacigos, *ex* Bangs & Zappey; diag.).

Thirty-six specimens: Nueva Gerona, Los Indios, and Santa Rosalia Lagoon.

Save for the changes incident to wear and fading, this series is fairly uniform. The greatest variation observable is that affecting the barring on the outer rectrices, which is very conspicuous in some individuals, in others almost obsolete. The middle rectrices vary somewhat also, the outer webs sometimes having a stripe of white along the shaft, and sometimes a row of spots. These variations occur in both sexes. Four nestlings from Los Indios, taken May 8, are interesting as showing that in juvenal dress the female has more or less red on the crown, thus approximating the pattern of the adult male, as in other species of this family.

Compared with specimens of true *superciliaris* from Guantánamo, Cuba, kindly loaned by Mr. Charles T. Ramsden, males from the Isle of Pines are somewhat smaller, but are little different in color, contrary to the claim of Mr. Bangs. The forehead, throat, and sides of the head average more brownish, less whitish, however, and the supraorbital black patch seems to average larger. Females of the two forms are of the same size, and the colors about the same also; in fact, the only distinguishing mark I can find is the much greater width of the black band on the crown in the birds from the Isle of Pines.

This woodpecker is one of the most abundant and generally distributed birds on the island, in spite of the persecution to which it is subjected by the inhabitants, because of the damage which it is said to do to grape-fruit, oranges, and guavas. The injury in question is done by puncturing the fruits to reach the soft, sweet pulp, for which the birds manifest a special fondness. As they are by no means shy, it is a simple matter to kill them under such circumstances. The nest is invariably built in a bottle-palm or royal palm, sometimes as low as four feet from the ground. Two sets, of five and six eggs respectively, were taken at Los Indios on May 3 and 5, while another nest found May 8 contained young not quite ready to fly.

92. **Priotelus temnurus vescus** Bangs & Zappey. ISLE OF PINES  
TROGON.

*Trogon temnurus* (not of Temminck) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Priotelus temnurus* CORY, Cat. W. Indian Birds, 1892, 103 (I. of Pines, in geog. distr.).

*Priotelus temnurus vescus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 204 (Los Almacigos, Pueblo Nuevo, Pasadita, and Cayo Bonito, orig. descr.; type now

in coll. Mus. Comp. Zool.; meas.; crit.; habits).—ALLEN, Auk, XXII, 1905, 329, in text (review).—EDITORS, Ibis, 1905, 631, in text (review).—READ, Oölogist, XXVI, 1909, 190 (I. of Pines), 223 (I. of Pines; descr.; habits); XXVIII, 1911, 13 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, V, 1911, 795 (Los Almacigos, Pueblo Nuevo, Pasadita, and Cayo Bonito, *ex* Bangs & Zappey; diag.).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, Oölogist, XXX, 1913, 122 (McKinley; habits).—READ, I. of Pines News, Nov. 8, 1914 (descr.; habits). "Isle of Pines Trogon" READ, Oölogist, XXVII, 1910, 5 (Nuevas River); XXVIII, 1911, 5 (McKinley; nesting); XXX, 1913, 123 (Nuevas River), 130 (I. of Pines), 168 (Los Indios).

Twelve specimens: Nueva Gerona, Hato, and Los Indios.

There is one female in juvenal dress, shot July 2. It resembles the adult, but is of course duller, the pileum with little bluish gloss, and the red of the under parts paler and mostly confined to the under tail-coverts. The tail and wings are not different from those of the adult, except that the white on the tips of the tertiaries is much reduced and confined to an oblong spot on the outer web.

## MEASUREMENTS.

4

*Priotelus temnurus temnurus*:

No.	Sex.	Locality.	Wing.	Tail.	Bill.
261 <sup>16</sup>	♂	Guantánamo, Cuba.....	129	123	18
772 <sup>16</sup>	♂	Guantánamo, Cuba.....	120	114	17.5
1019 <sup>16</sup>	♂	Holguin, Cuba.....	120	115	
14925 <sup>17</sup>	♂	Holguin, Cuba.....	123.5	120.5	18.5
14927 <sup>17</sup>	♂	Holguin, Cuba.....	124	118	19
14928 <sup>17</sup>	♂	Holguin, Cuba.....	123	118	17.5
11976 <sup>17</sup>	♂	El Guama, Cuba.....	124	120	20

*Priotelus temnurus vescus*:

3947 <sup>618</sup>	♂	Nueva Gerona, I. of Pines.....	111	100	18
41131 <sup>18</sup>	♂	Nueva Gerona, I. of Pines.....	115	118	17.5
41220 <sup>18</sup>	♂	Nueva Gerona, I. of Pines.....	113	108	18
41246 <sup>18</sup>	♂	Los Indios, I. of Pines.....	116	109	18
41340 <sup>18</sup>	♂	Los Indios, I. of Pines.....	118	106	17
13250 <sup>17</sup>	♂	Los Almacigos, I. of Pines.....	113.5	104	19.5
13251 <sup>17</sup>	♂	Los Almacigos, I. of Pines.....	115	104	19
13254 <sup>17</sup>	♂	Cayo Bonito, I. of Pines.....	114	106	19.5
13255 <sup>17</sup>	♂	Cayo Bonito, I. of Pines.....	113	110	18.5
13258 <sup>17</sup>	♂	Pueblo Nuevo, I. of Pines.....	114	108	18.5

<sup>16</sup> Collection Charles T. Ramsden.

<sup>17</sup> Collection E. A. and O. Bangs.

<sup>18</sup> Collection Carnegie Museum.

After actually comparing a series of specimens in the same seasonal plumage I must confess that I am not very favorably impressed with the claim of the bird from the Isle of Pines to recognition by name. There is certainly not the slightest difference in color, and the average difference in size seems scarcely of sufficient importance to justify formal separation. Mr. Ridgway speaks of the red color beneath being appreciably lighter, but I am persuaded that he was dealing with examples in more or less faded dress. This red area seems to average smaller, however, than in the Cuban birds I have examined, although this may be due to the make-up of the skins. Both Mr. Bangs' measurements (some of which I have quoted in the above table), Mr. Ridgway's, and my own, averaging substantially the same as they do, seem scarcely to afford sufficient ground, in my judgment, for the recognition of two subspecies, and I admit such only provisionally.

This brilliant species is common in the jungles, or dense tropical forests found in the river valleys and on the mountain slopes. For a perch it chooses an exposed situation, whence it sallies forth after passing insects, returning to the same branch, in the manner of a flycatcher. Small wild fruits are also eaten at times. As a rule it occurs in pairs, or occasionally three or four may be seen together. "It is a stupid sluggish bird and very tame," scarcely deigning to move out of the way when approached. It has a loud call, repeated at intervals, which has given rise to its native name of "Tocororo." The nest is doubtless built in hollow trees, as is the case with other species of this group; at any rate, Mr. Read mentions having flushed a bird of this species from an old woodpecker's hole in a bottle-palm, on June 25, 1910.

***Nephæcetes niger niger* Gmelin. BLACK SWIFT.**

(?) "Chimney Swift" (error) Read, *Oölogist*, XXVI, 1909, 58, 102 (I. of Pines).

(?) *Cypseloides niger*? READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines).

—READ, *Oölogist*, XXVI, 1909, 125, and XXVIII, 1911, 12, and XXX, 1913, 131 (I. of Pines).

Although this species has long been known from Cuba, where, however, it appears to be rare and local, the above records for the Isle of Pines are admittedly doubtful, resting as they do on imperfect identifications of individuals noted by Mr. Read on at least two occasions. The actual capture of specimens is the only sufficient ground for the admission of such a species as this to the Isle of Pines list.



93. *Streptoprocne zonaris pallidifrons* (Hartert). ANTILLEAN COL-  
LARED SWIFT.

*Hemiprocna* [sic] *zonaris pallidifrons*? BANGS & ZAPPEY, Am. Nat., XXXIX, 1905,  
203 (Nueva Gerona, *fide* Palmer & Riley).

*Streptoprocne zonaris pallidifrons* READ, Forest and Stream, LXXIII, 1909, 452  
(I. of Pines).—READ, Oölogist, XXVIII, 1911, 12, and XXX, 1913, 131 (I. of  
Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, V, 1911, 701 (Nueva Gerona,  
*ex* Bangs & Zappey).

Messrs. Palmer and Riley say that "a large swift with some white  
beneath was seen around the [Casas or Caballos] mountains on several  
occasions." This description will not fit any known species of this  
family from the West Indies other than the present, which it is fair to  
presume was the one in question. Mr. Link did not meet with this or  
any other swift, but Mr. Read claims to have observed it on at least  
one occasion (January 31, 1909). Its range is known to include  
Cuba, Haiti, and Jamaica, and thus inferentially the Isle of Pines,  
but specimens from the latter island are naturally very desirable in  
order to support the present not entirely satisfactory records.

94. *Tachornis phœnicobia yradii* (Lembeye). CUBAN PALM SWIFT.

*Tachornis phœnicobia* (not of Gosse) READ, Forest and Stream, LXXIII, 1909, 452  
(I. of Pines).—Read, Oölogist, XXVI, 1909, 124, and XXVIII, 1911, 12 (I.  
of Pines).

"Palm Swift" READ, Oölogist, XXVII, 1910, 5 (Nuevas River); XXVIII, 1911,  
113 (West McKinley); XXX, 1913, 131 (I. of Pines).

Mr. Read appears to be the only observer to have noted this species,  
which he records as "common in summer," being in evidence just  
before and just after a rain. In reply to a request for further infor-  
mation he writes as follows: "I have seen it closely on many occasions  
and have watched it for a considerable time in clearings along the  
Nuevas River. I see three or four pairs of these birds almost daily  
in the Santa Barbara nursery, where they are nesting in the stub of a  
royal palm. This bird is readily recognized and is very tame, not  
paying the least attention to an intruder, and although it is always seen  
on the wing it cannot be mistaken for any other swift because of its  
small size and very noticeable white throat and rump." Such a cir-  
cumstantial account as this leaves little room for doubt as to identi-  
fication, but specimens are still desiderata. Although Mr. Link was  
constantly on the lookout for swifts during his stay in the island, he  
did not see a single one. There are numerous Cuban records for the  
present species.

95. *Calypte helenæ* (Lembeye). HELENA HUMMINGBIRD.

(?) "Black-throated Hummer?" READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines).—READ, *Oölogist*, XXVI, 1909, 75, and XXVIII, 1911, 12 (I. of Pines), 113 (West McKinley).

Ten specimens: Caleta Grande and Los Indios.

Mr. Read's records above quoted, so he writes me, presumably refer to this diminutive species, which has not heretofore been recorded from the Isle of Pines. Mr. Link found it tolerably common in April and May at Caleta Grande and Los Indios, feeding among the red blossoms of the *Jatropha glaucovirens*. Between this species and the Ricord Emerald a great antipathy exists, the former being driven off from its feeding-grounds by the other whenever they come together. The series secured includes but one adult male, which I am unable to distinguish in any way from specimens collected in eastern Cuba; the females from the two islands are also precisely alike. Most of the published records for Cuba seem to pertain to the eastern part of the island.

96. *Riccordia ricordii ricordii* (Gervais). RICORD EMERALD.

*Orthorhynchus ricordii* POEY, *Mem. Hist. Nat. Cuba*, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Riccordia ricordii* BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 203 (Los Almacigos and Santa Fé; habits).—READ, *Oölogist*, XXVI, 1909, 190, and XXVIII, 1911, 12 (I. of Pines); XXVII, 1910, 61 (I. of Pines; descr.; habits).

"Ricord's Hummer" READ, *Oölogist*, XXVIII, 1911, 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 125 (Santa Barbara), 130 (I. of Pines).

*Riccordia ricordii ricordii* RIDGWAY, *Bull. U. S. Nat. Mus.*, No. 50, V, 1911, 543 (Los Almacigos and Santa Fé, *ex* Bangs & Zappey; meas.).—READ, *Bird-Lore*, XV, 1913, 45 (Santa Barbara).

Seventeen specimens: Los Indios, Siguanea, and Nueva Gerona.

Although at one time (*cf.* ANNALS CARNEGIE MUSEUM, VII, 1911, 424) I had doubts as to the distinctness of the Bahaman form of *Riccordia ricordii*, comparison with the present fine series has served to dispel them, so that the trinomial name is very properly employed here.

This hummingbird is a very common species in the Isle of Pines, occurring almost everywhere, except in the swampy country. It is particularly numerous on the wooded slopes of the Casas Mountains, frequenting the flowers which grow so profusely there during the rainy season, and is common also in the country back of Caleta Grande.

"It is a noisy little bird and its mouse-like, squeaking note is uttered at frequent intervals, especially when anything attracts its attention." A nest found by Mr. Link at Los Indios early in May was built in a grape-fruit tree, three or four feet from the ground, and at that time contained two eggs, highly incubated. Another found on the slopes of the Casas Mountains in June, and containing young, was also similarly placed at a low elevation.

97. *Tyrannus dominicensis dominicensis* (Gmelin). GRAY KINGBIRD.

*Tyrannus dominicensis* CORY, Cat. W. Indian Birds, 1892, 108 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVIII, 1911, 7, 12 (I. of Pines; habits; nesting).—READ, I. of Pines News, VI, Jan. 10, 1914 (I. of Pines, summer; descr.).

*Tyrannus dominicensis dominicensis* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 207 (Santa Fé, El Hospital, Cayo Bonito, and Jucaro).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 706 (I. of Pines; meas.).

"Gray Kingbird" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 42 (I. of Pines; nesting), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 7 (I. of Pines), 10 (Nuevas River), 113 (West McKinley); XXX, 1913, 125 (Santa Barbara; migr.)

"Cuban Gray Kingbird" READ, Oölogist, XXX, 1913, 181 (I. of Pines, summer).

Four specimens: Bibijagua, Los Indios, and Nueva Gerona.

This species is well known to be migratory in the northern part of its range, and even in Cuba Gundlach says that it is only a summer resident from March to September. Mr. Read claims a similar seasonal status for the species in the Isle of Pines, but Mr. Link actually secured specimens on December 11, January 18, and February 5, thus showing that its occurrence through these months is at least proven. It is an inhabitant of the more open situations, the pine woodlands, palmetto-growths, and citrus-groves, where it comes in contact with the Cuban Petchary, which it very closely resembles in habits. Mr. Read mentions having found a nest with eggs on April 11, 1909, placed in a low tree only six feet from the ground, and close to a building. Messrs. Palmer and Riley found a nest near Nueva Gerona on July 8, 1900, containing two eggs on the point of hatching.

98. *Tyrannus cubensis* Richmond. GIANT KINGBIRD.

*Tyrannus magnirostris* (not of Swainson) CORY, Cat. W. Indian Birds, 1892, 108 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 80 (I. of Pines).

*Tyrannus cubensis* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 207 (Santa Fé, La Vega, Los Almacigos, and Mal Pais).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 711 (I. of Pines; meas.).—READ, Oölogist, XXVI, 1909, 124,

and XXVIII, 1911, 12 (I. of Pines), 8 (Nuevas River; habits).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, I. of Pines News, VI, Jan. 10, 1914 (I. of Pines, summer, not common).

"Giant Kingbird" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVIII, 1911, 7 (I. of Pines), 10 (Nuevas River); XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines).

Two specimens: Los Indios.

All observers agree as to the comparative scarcity of this large flycatcher in the Isle of Pines. Indeed, Mr. Link met with it on but one occasion, securing a pair at Los Indios early in May. These are both in worn breeding dress, and the male is apparently not fully mature, lacking attenuated tips to the outer primaries. Mr. Zappey secured five specimens in the eastern part of the island—all shot in the vicinity of water. Mr. Read says that it is "fairly common along the Nuevas River, where it may often be seen catching insects over the water and occasionally minnows which are swimming near the surface, returning to an overhanging branch to swallow its prey after the fashion of a Kingfisher." The stomachs examined by Messrs. Zappey and Link, however, contained nothing but insects and a few berries. Despite Mr. Read's statement that this species is exclusively a summer resident, there can be no question as to its occurrence in the Isle of Pines throughout the year as in Cuba, since there are no records of its being found to the southward.

99. *Tolmarchus caudifasciatus* (D'Orbigny). CUBAN PETCHARY.

*Tyrannus caudifasciatus* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Pitangus caudifasciatus* GUNDLACH, Orn. Cubana, 1895, 83 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 206 (Santa Fé, El Hospital, Jucaro, and Cayo Bonito).

*Tolmarchus caudifasciatus* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 679 (Nueva Gerona; Santa Fé, El Hospital, Jucaro, and Cayo Bonito, *ex* Bangs and Zappey; meas.).—READ, Oölogist, XXVIII, 1911, 7 (I. of Pines; habits); XXX, 1913, 122 (McKinley; habits).—READ, I. of Pines News, V, Oct. 25, 1913 (descr.; habits).

(?) "Kingbird" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58, 102, and XXVIII, 1911, 12 (I. of Pines).

"Cuban Kingbird" READ, Oölogist, XXVII, 1910, 5 (Nuevas River), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley and Santa Barbara Mountain, etc.), 5 (McKinley; nesting), 6, 10 (Nuevas River), 7 (Cañada Mountains, etc.), 113 (West McKinley), 146 (Bibijagua); XXX, 1913, 123 (Nuevas River), 125 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).

Thirteen specimens: Bibijagua, Los Indios, Sigüanea, and Santa Rosalia Lagoon.

This species is subject to much variation from wear and fading, which render the upper parts darker and duller, remove the pale greenish yellow edgings of the remiges, and turn the same color on the under tail-coverts into white. In fresh plumage the back is glossed with olivaceous green.

A very common bird throughout the drier parts of the island, frequenting the more open situations, where it is usually found in pairs or family groups. In its notes and general habits it closely resembles the Kingbird of the north, and like that species will chase any large bird which happens to invade its territory, even the Turkey Buzzard being an object of its antipathy. It is said to be very fond of the "bibijagua" ant, on occasion alighting on the ground to devour the winged females, as they emerge in swarming time. According to Mr. Read it begins to nest about the middle of April, building a frail structure of twigs and rootlets in a low tree. Two nests found by Mr. Link near Nueva Gerona had eggs in May.

100. *Myiarchus sagræ sagræ* (Gundlach). LA SAGRA FLYCATCHER.

*Myiarchus sagræ* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 207 (Santa Fé, Cayo Bonito, and Jucaro).—READ, Oölogist, XXVIII, 1911, 8, 12 (I. of Pines; habits).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

*Myiarchus sagræ sagræ* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 636 (I. of Pines; meas.).

(?) "Phoebe?" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVIII, 1911, 13 (I. of Pines), 113 (West McKinley).

"Cuban Crested Flycatcher" READ, Oölogist, XXVI, 1909, 224 (I. of Pines), XXVIII, 1911, 6, 11 (Nuevas River), 7 (Cañada Mountains, etc.), 114 (West McKinley); XXX, 1913, 125, 127 (Santa Barbara), 130 (I. of Pines).

Nine specimens: Los Indios, Majagua River, Cayo Frances, and Nueva Gerona.

These birds agree well with specimens from eastern Cuba. Both series differ from the Bahaman form (*lucaysiensis*) not only in the respects pointed out by Mr. Ridgway in his diagnosis, but also in having less rufous on the rectrices, the outer one (in all but two specimens) having practically no rufous apparent, except at the base.

Mr. Zappey did not meet with this flycatcher, except in the pine-woods, where it was common in April, May, and June, but according



to Mr. Link's experience it is by no means confined to such situations, being apt to occur in almost any kind of woods, where it is not swampy. Near the mouth of the Majagua River, as well as on Cayo Frances, it was even found in the mangroves, while at Los Indios it frequented the same dense thicket where the Cuban Wood Pewee was so much in evidence. Until now no nests appear to have been discovered in the Isle of Pines.

101. **Blacicus caribæus** (D'Orbigny). CUBAN WOOD PEWEE.

*Muscipeta caribæa* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Blacicus caribæus* CORY, Cat. W. Indian Birds, 1892, 109 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 87 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 207 (San Juan and Santa Fé).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 533 (San Juan and Santa Fé, *ex* Bangs and Zappey; meas.; crit.).—READ, Oölogist, XXVIII, 1911, 9, 12 (I. of Pines; habits).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

"Cuban Wood Pewee" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River).

"Cuban Pewee" READ, Oölogist, XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley), 5 (Santa Barbara Mountain, etc.), 7 (Cañada Mountains, etc.), 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (Nuevas River), 125, 127 (Santa Barbara), 131 (I. of Pines).

Twelve specimens: Los Indios.

The specimens measured agree well with those from this island handled by Mr. Ridgway in being slightly smaller than Cuban examples. They all came from Los Indios, where the species was found to be common in a dense thicket at the edge of a pasture. Some were also seen near Nueva Gerona, while Mr. Zappey's and Mr. Read's records pertain to other sections of the island, so that the species appears to be quite generally distributed, except in the swampy country. In its general habits it resembles the common Wood Pewee, usually perching rather low down, however, and being very tame and unsuspicious. There appear to be no actual records of its nesting in the Isle of Pines, but according to Gundlach it builds a nest on a horizontal branch, much after the style of the common Wood Pewee.

**Empidonax flaviventris** (Baird). YELLOW-BELLIED FLYCATCHER.

(?) "Yellow-bellied Flycatcher" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, Apr. 28).—READ, Oölogist, XXVI, 1909, 102, and XXVIII, 1911, 12, and XXX, 1913, 131 (I. of Pines).

This species is generally believed to migrate entirely through Mexico, avoiding the West Indies. The above records published by Mr. Read are therefore open to question.

102. *Mimus polyglottos polyglottos* (Linnæus). MOCKINGBIRD.

One specimen: Nueva Gerona.

A single specimen, unquestionably referable to the continental form, was shot by Mr. Link at Nueva Gerona on December 30. This is a female, comparing favorably in size, grayish coloration, and color-pattern of rectrices with birds of that sex from Florida, and it doubtless is a winter migrant from that State. In this specimen even the outer webs of the outer rectrices are somewhat blackish, and the flanks show obsolete streaks.

103. *Mimus polyglottos orpheus* (Linnæus). JAMAICAN MOCKINGBIRD.

*Mimus polyglottos orpheus* CORY, Cat. W. Indian Birds, 1892, 121 (I. of Pines, in geog. distr.).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 231 (I. of Pines, in geog. distr.).

*Mimus orpheus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 207 (I. of Pines, *ex* Cory; "south coast").

One specimen: Nueva Gerona.

Mr. Cory records this species from the Isle of Pines without comment, and this record, doubtless given on Gundlach's authority, has been quoted by Mr. Ridgway and Messrs. Bangs and Zappey. The latter authors add that "the mockingbird is said by the natives to inhabit the south coast in small numbers." Whether or not this statement is true, nothing is more certain than that the bird is rare on the island, so that Mr. Link's record, pertaining to an individual shot in a palmetto growth near Nueva Gerona on March 10, is valuable as the first circumstantial record. The individual taken was a male, perfectly typical of this form. More recently Mr. Read writes that he has seen four individuals, two together at La Ceiba at the foot of the mountains, and the other two singly in Santa Barbara proper. One of the latter was secured, and through the courtesy of the U. S. National Museum, to which the specimen was sent, is now before me for examination. It was shot April 8, 1915, is marked as a male, "shot while singing," and measures as follows: wing, 100; tail, 101. In size it thus agrees best with *orpheus*, but in color-characters it is quite indistinguishable from true *polyglottos*, so that I am at a loss as to which form it should really be referred.

104. *Dumetella carolinensis* (Linnæus). CATBIRD.

*Turdus carolinensis* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Galeoscoptes carolinensis* CORY, Cat. W. Indian Birds, 1892, 121 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1893, 51 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 207 (I. of Pines; Poeys, Cory's, and Gundlach's records).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 218 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

"Catbird" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, December).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 15, and XXVIII, 1911, 7 (I. of Pines; migr.), 118 (West McKinley); XXX, 1913, 123 (McKinley), 130 (I. of Pines, winter).

Two specimens: Caleta Grande and Los Indios.

A common winter resident, arriving from the north, according to Mr. Read, in October (October 16, 1909; October 27, 1910) or even earlier (September 19, 1913), and remaining until May at least. Mr. Link saw a few near Nueva Gerona the middle of May, while a straggler was noted at Pasadita as late as May 25—a date when the bird has eggs in Pennsylvania. Mr. Read writes that he saw flocks of twenty-five or thirty birds on April 17, 1915, these being the first migrating flocks noticed that season. During its winter sojourn in the island it inhabits the same general kind of situations as in its summer home—bushy thickets, where it keeps well concealed, although its presence is usually revealed by its characteristic notes, uttered when its haunts are invaded. Its spring song was not heard at any time.

105. *Myadestes elisabeth* (Lembeye). CUBAN SOLITAIRE.

*Myiadeses elisabeth* GUNDLACH, Journ. für Orn., 1856, 2 (I. of Pines [error; *cf.* GUNDLACH, Journ. für Orn., 1872, 429, and STEJNEGER, Proc. U. S. Nat. Mus., V, 1882, 27]).—CORY, Cat. W. Indian Birds, 1892, 122 (I. of Pines, in geog. distr. [error]).—GUNDLACH, Orn. Cubana, 1895, 89 (no valid record from I. of Pines).

*Myiadeses elisabeth retrusus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 208 (Pasadita; orig. descr.; type now in Mus. Comp. Zool.; habits).—ALLEN, Auk, XXII, 1905, 329, in text (review).—EDITORS, Ibis, 1905, 631, in text (review; crit.).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, IV, 1907, 173 (I. of Pines; descr.; syn.).

Mr. Charles T. Ramsden has sent me a small but very interesting series of *Myadestes elisabeth* from eastern Cuba, which I have been able to compare directly with the type and only known specimen of the alleged subspecies *retrusus*. Three of these Cuban specimens are

decidedly olivaceous brown above and shaded with grayish below. Two of these are completing the postnuptial moult (August 29), and the third is in comparatively fresh plumage (March 22). A fourth specimen, however, although taken only a day later than the last, is a precise counterpart in all respects of the type of *retrusus*. This latter individual is somewhat worn (May 25), and I believe that its pale coloration is due to fading rather than to any geographical variation. At all events, until its characters can be substantiated by additional specimens in fresh plumage, I cannot see my way clear to accord recognition to the form it is supposed to represent.

The Solitaire was reported from the Isle of Pines by Gundlach many years ago, on what he discovered later was unreliable authority. The capture of a single specimen by Mr. Zappey at Pasadita therefore constitutes the first authentic record for the island. "The Isle of Pines Solitaire is very rare and occurs in the densest forests only, where, on account of its retiring habits and dull coloration, it is very hard to shoot. Its loud, ringing song can be heard a great distance, and is almost startling in the still forests in which the bird lives. The stomach of the only specimen taken contained a few berries and the remains of insects." A bird believed to have been of this species was seen by Mr. Link at Hato, on the "south coast," on October 17, 1912, but was unfortunately not secured. The natives here appear to be acquainted with the bird, but say it is very rare.

106. *Mimocichla rubripes rubripes* (Temminck). RED-LEGGED THRUSH.

*Turdus rubripes* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Mimocichla rubripes* CORY, Cat. W. Indian Birds, 1892, 122 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 49 (I. of Pines).—READ, Oölogist, XXVIII, 1911, 13 (I. of Pines); XXX, 1913, 122 (McKinley; habits).

*Mimocichla rubripes rubripes* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 208 (Santa Fé, San Juan, El Hospital, and Cayo Bonito; habits; crit.).—READ, Oölogist, XXVI, 1909, 124 (I. of Pines; nesting).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, I. of Pines News, V, Oct. 18, 1913 (descr.; habits).

"Red-legged Thrush" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River), 42 (I. of Pines; nesting), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley), 5 (McKinley and Santa Barbara Mountain; nesting), 6, 11 (Nuevas River), 113 (West McKinley), 146 (Bibijagua); XXX, 1913, 123 (Pine River), 125, 127 (Santa Barbara), 130 (I. of Pines), 164 (Santa Barbara to Nueva Gerona), 168 (Los Indios).

Twenty-two specimens: Nueva Gerona, Los Indios, and McKinley.

The series exhibits considerable variation in the depth and extent of the abdominal tawny ochraceous area (not depending on sex, however), while the amount of white streaking on the throat is another variable character.

A very common species in the Isle of Pines, taking the place of the Robin in the north, and closely resembling it in general habits. While it is perhaps more partial to the woodland areas than the Robin, it often comes familiarly about the houses and cultivated grounds, and frequently builds its nest in such situations. Mr. Read writes of a pair which built a nest on a rafter in an unfinished house, removing it later to another situation, and Mr. Link saw the same thing happen on one occasion. The nest, too, is like that of the Robin in general appearance, except that it lacks the lining of mud, fibrous roots doing duty instead, and the eggs are laid in April and May. Three or four eggs appear to be the usual complement; they are pale greenish, finely spotted with several shades of brownish. During the nesting-season the males are accustomed to sing in the morning and evening, their song again reminding one of that of the Robin, but being much weaker. At other seasons the birds are nearly silent, merely giving utterance to a sharp note of alarm when disturbed, nor do they come about houses to the same extent. Berries and insects constitute their food, and Mr. Read mentions having seen a lizard fed to the young on one occasion.

***Hylocichla ustulata swainsonii* (Cabanis). OLIVE-BACKED THRUSH.**

(?) "Olive-backed Thrush" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, Jan. 14).—READ, Oölogist, XXVI, 1909, 58, and XXVIII, 1911, 7 (I. of Pines; migr.), 113 (West McKinley).

(?) *Hylocichla ustulata swainsonii* READ, Oölogist, XXVIII, 1911, 13 (I. of Pines).

Mr. Read claims to have observed this species on a few occasions, in October and even in January (!), but as no specimens appear to have been preserved, and the species is not known to migrate through the West Indies, and is merely accidental in Cuba, it seems possible that his records are due to misidentifications, which are very easy to make in this group.

**107. *Poliophtila cærulea cærulea* (Linnæus). BLUE-GRAY GNAT-CATCHER.**

*Culicivora cærulea* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Poliophtila cærulea* CORY, Cat. W. Indian Birds, 1892, 120 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1893, 54 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 205 (I. of Pines, March; Poey's record).



Both Poey, Cory, and Gundlach record the Blue-gray Gnatcatcher from the Isle of Pines, and Mr. Zappey found it there in March, 1902, but not on his later trip. Mr. Link did not chance to meet with it. It is obviously a winter resident, as in Cuba, where according to Gundlach it is abundant.

108. **Corvus nasicus** Temminck. CUBAN CROW.

*Corvus jamaicensis?* (not of Gmelin) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Corvus nasicus* CORY, Cat. W. Indian Birds, 1892, 110 (I. of Pines, in geog. distr.).  
—GUNDLACH, Orn. Cubana, 1895, 126 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 209 (La Vega and Pasadita; habits).

"Cuban Crow" READ, Oölogist, XXX, 1913, 130 (I. of Pines, *vide* G. A. Link).

Eleven specimens: Caleta Grande, Caleta Cocodrilos, Jacksonville, and Pasadita.

A common species in the Cienaga at Pasadita, where it was found by both Mr. Zappey and Mr. Link. The latter observer failed to meet with it at the western end of the Cienaga, near Siguanea, although it was noted in comparative abundance on the "south coast." A nest was discovered at Jacksonville on April 21, containing one addled egg and three newly hatched young. The egg resembles that of the Common Crow, but the ground-color is much paler. The nest was a mass of sticks, bark, etc., placed on a star-palm about twenty feet from the ground. The Cuban Crow is less wary and difficult of approach than the northern species, and has a great variety of notes and calls, reminding one of the Raven in this respect.

109. **Vireo gundlachii gundlachii** Lembeye. GUNDLACH VIREO.

*Vireo gundlachi* CORY, Cat. W. Indian Birds, 1892, 116 (I. of Pines, in geog. distr.).

—GUNDLACH, Orn. Cubana, 1893, 45 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 209 (Cayo Bonito; crit.).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).

"Gundlach's Vireo" READ, Oölogist, XXVIII, 1911, 11 (Nuevas River), 13 (I. of Pines); XXX, 1913, 123 (McKinley), 125 (Santa Barbara), 130 (I. of Pines).

Six specimens: Caleta Grande and Nueva Gerona.

A single example of this interesting species was secured by Mr. Link at Caleta Grande on November 29. Later, in February and March, it was encountered near Nueva Gerona also, and a few additional specimens were obtained, the series being very uniform in coloration. All of these were shot in bushy thickets, similar to those in which the Black-whiskered Vireo was found. The species appears to be rather

uncommon, however, and has been recorded by Mr. Read on only a few occasions. Mr. Zappey secured a pair at Cayo Bonito on May 3, these being the only ones he saw on his second trip. These examples proved on comparison with Cuban specimens to differ in certain particulars, suggesting that subspecific separation might eventually become necessary. I have been able to compare the present series with a good series of Cuban birds, comprising specimens taken from both the eastern and the western parts of the island. Considerably to my surprise I find that the bird of western Cuba is readily separable from that of the eastern part (Guantánamo and Santiago de Cuba), the Isle of Pines specimens naturally agreeing with the western form, averaging merely a trifle duller. Lembeye (*Aves de la Isla de Cuba*, 1850, 29, pl. 5, fig. 1) does not specify any particular type-locality for his *Vireo gundlachii*, although he mentions that he first saw the species near Cienfuegos, so that we are doubtless justified in accepting this as the type-locality. No specimens from this point are available, but nine skins from Trinidad, some forty miles to the eastward, kindly placed at my disposal by Mr. Frank M. Chapman, while obviously intermediate in their characters, seem best referred to the western form. The bird of eastern Cuba I therefore propose to call

***Vireo gundlachii orientalis* subsp. nov.**

*Type*, No. 44,219, Collection Carnegie Museum, adult male; Arroyo Hondo, "Los Caños," Guantánamo, Cuba, October, 1913; Charles T. Ramsden.

*Subspecific characters*.—Similar to *Vireo gundlachii gundlachii* of western Cuba and the Isle of Pines, but general coloration duller; under parts much duller yellow, with more buffy suffusion and dark shading on the sides; lores and postocular spot paler yellow; and upper parts decidedly grayish, less greenish.

*Vireo gundlachii* is thus shown to vary precisely as do certain other closely related species, but in this case the variation is strictly correlated with locality, which is not true with *V. carmioli*, *V. ochraceus*, or even *V. crassirostris*.

**110. *Vireo griseus griseus* (Boddaert). WHITE-EYED VIREO.**

*Vireo griseus griseus* READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).

Two specimens: Caleta Grande and Nueva Gerona.

Gundlach says that the White-eyed Vireo is rare in Cuba, where it occurs as a winter visitor. Under such circumstances Mr. Link's records, referring to single individuals killed at Caleta Grande on November 27, and at Nueva Gerona on February 26, are of especial interest, as going to show that the species has a similar seasonal status in the Isle of Pines also. Mr. Read claims to have observed it at Santa Barbara on December 13, 1912.

**Lanivireo flavifrons** (Viellot). YELLOW-THROATED VIREO.

(?) "Yellow-throated Vireo" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, May 8).—READ, Oölogist, XXVI, 1909, 102, and XXX, 1913, 131 (I. of Pines); XXVIII, 1911, 113 (West McKinley).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Vireo flavifrons* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

The Yellow-throated Vireo is of merely casual appearance in the West Indies, migrating as it does through Mexico and Central America, so that Mr. Read's records above quoted, all apparently referring to a single individual noted May 8, 1909, cannot be received with that degree of confidence necessary to assure the species a place on the list.

**III. Vireosylva calidris barbatula** (Cabanis). BLACK-WHISKERED VIREO.

*Vireo calidris barbatulus* CORY, Cat. W. Indian Birds, 1892, 115 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

*Vireosylva barbatula* GUNDLACH, Orn. Cubana, 1895, 41 (I. of Pines).

*Vireosylva calidris barbatula* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, III, 1904, 141 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 209 (Jucaro, Cayo Bonito, and Santa Fé).

"Black-whiskered Vireo" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 75 (I. of Pines); XXVII, 1910, 42 (I. of Pines; nesting), 84 (Los Tres Hermanos Mountains); XXVIII, 1911, 7 (I. of Pines), 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 125 (Santa Barbara; migr.; habits), 131 (I. of Pines; migr.).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

Ten specimens: Nueva Gerona.

These are precisely like Bahaman specimens. *V. c. barbatula* differs from *V. c. calidris*, in addition to the characters usually recognized, in having the under tail-coverts paler yellow.

A summer resident, arriving about the middle of March, and remaining until October, although according to Mr. Read a few stragglers may stay through the dry season. It is a common inhabitant of the low thickets and jungles, where its song, which is a sweet warble not unlike that of the Red-eyed species, is a constant reminder

of its presence. Mr. Read records a nest found on April 24, 1909, while Mr. Link reports that he found one containing two eggs the second week in June, placed about fifteen feet from the ground, on a horizontal branch of a hardwood tree. Mr. Link did not meet with this species except in the neighborhood of Nueva Gerona, where it was particularly numerous on the slopes and at the foot of the Casas and Caballos Mountains, but Mr. Zappey and Mr. Read have recorded it from sundry other parts of the island.

**Vireosylva olivacea** (Linnæus). RED-EYED VIREO.

(?) "Red-eyed Vireo" READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines, April 21).—READ, *Oölogist*, XXVI, 1909, 75 (I. of Pines); XXVIII, 1911, 7 (I. of Pines; migr.), 113 (West McKinley); XXX, 1913, 131 (I. of Pines; migr.).—READ, *I. of Pines News*, VI, Feb. 14, 1914 (I. of Pines).

(?) *Vireo olivaceus* READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

This is another species admitted to Mr. Read's list on what are probably insufficient grounds, since it does not appear that specimens were taken or preserved. Like the Yellow-throated Vireo, the Red-eyed species migrates through Mexico and Central America, and its occurrence anywhere in the West Indies is merely casual. Indeed, Gundlach says that in all his experience in Cuba he secured but a single specimen.

**I12. *Hirundo erythrogastra* Boddaert.** BARN SWALLOW.

"Barn Swallow" READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines, April 11).—READ, *Oölogist*, XXVI, 1909, 75 (I. of Pines); XXVIII, 1911, 7, and XXX, 1913, 131 (I. of Pines; migr.).—READ, *I. of Pines News*, VI, Apr. 11, 1914 (I. of Pines, migrant).

*Hirundo erythrogastra* READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

Two specimens: Los Indios and Nueva Gerona.

A transient visitant only, apparently not common. Its seasonal occurrence is doubtless the same here as in Cuba, where Gundlach says it comes from the north in August, remaining but a short time, however, and reappearing in its northward migration in April and May. The first specimen secured by Mr. Link, however, was shot at the rather late date of November 4, at Los Indios. It is an immature male, with the wings and tail fresh and unworn, the white edgings very prominent. A few new chestnut feathers have come in on the forehead, but there are no other signs of moult in progress. Another example was shot at Nueva Gerona on May 12, being one of several seen. Mr. Read has recorded it as early in the spring as March 18 (1912) and April 11 (1909), and as late as May 8 (1910).

**Riparia riparia** (Linnæus). BANK SWALLOW.

(?) "Bank Swallow" READ, I. of Pines News, VI, Apr. 11, 1914 (I. of Pines, March 4, 1914.)

The Bank Swallow is a rare transient in the West Indies, and the only record we have of its occurrence in the Isle of Pines is the one by Mr. Read above quoted, which, however, does not appear to be based on an actual capture. Mr. Link says that a swallow which he took to be this species was nesting in holes in low banks along the Casas River in May, but no specimens were taken, and the identification is open to question. The locality is certainly beyond the known southern breeding range of the Bank Swallow, while the Rough-winged Swallow is not even known from the West Indies, so that the identity of these particular birds is problematical, and specimens are very desirable.

**113. Petrochelidon fulva fulva** (Vieillot). CUBAN CLIFF SWALLOW.

*Petrochelidon fulva fulva* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, III, 1904, 53 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 209 (Nueva Gerona, *vide* Palmer and Riley).

"Cuban Cliff Swallow" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 102, and XXVIII, 1911, 7 (I. of Pines), 6 (Nuevas River), 114 (West McKinley); XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines, summer; migr.).

*Petrochelidon fulva* AMERICAN ORNITHOLOGISTS' UNION COMMITTEE, Check List N. Am. Birds, ed. 3, 1910, 292 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, I. of Pines News, VI, Apr. 11, 1914 (Nueva Gerona; descr.; habits).

Four specimens: Bibijagua and Nueva Gerona.

The seasonal status of the present species appears to be the same as that of the Cuban Martin, a summer resident only, of which the winter habitat is still unknown. Mr. Read records its arrival in 1914 on March 4, and Gundlach says that in Cuba it comes at the end of February or early in March. Messrs. Palmer and Riley found it common in the lowlands in the vicinity of Nueva Gerona in July, at which time the young had begun to collect in flocks on the telegraph wires. Mr. Link found it common here also in May and June, and was fortunate in discovering its nesting-grounds in the Casas and Caballos Mountains. As early as April 6, in the latter locality, the birds were observed going in and out of holes in the cliffs near the tops of the mountains, where they evidently had eggs or young. These nesting-places were quite inaccessible by ordinary means, but a little later, in the Casas Mountains, some pairs were found with nests only about twenty feet up the face of an exposed cliff. Mr. Read speaks of having seen the birds gathering nesting-material in the shape of little pellets of clay from the edges of water-holes in Nueva Gerona.



114. *Progne cryptoleuca* Baird. CUBAN MARTIN.

*Progne cryptoleuca* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 209 (Manigua *vide* Palmer and Riley).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, I. of Pines News, VI, Apr. 4, 1914 (I. of Pines, summer; habits).  
 "Cuban Martin" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 75 (I. of Pines); XXVIII, 1911, 5 (McKinley; nesting), 7 (I. of Pines; migr.), 11 (Nuevas River), 114 (West McKinley); XXX, 1913, 125 (Santa Barbara; migr.), 128, pl. (Santa Barbara; fig. of nesting site), 130 (I. of Pines, summer; migr.).

Two specimens: Los Indios.

Swallows believed to belong to this species were repeatedly observed along the Casas River at Nueva Gerona, but no specimens were procured except at Los Indios, where a pair were shot on April 12. Mr. Zappey noted it on several occasions, and Messrs. Palmer and Riley found it in small colonies in the pines at Manigua. Mr. Read appears to be the only observer to have met with it in any numbers. He states that it is a summer resident only, appearing as early sometimes as February 8 (1914), March 12 (1912), and March 28 (1910), and remaining until about the first of November. This agrees with what is known concerning its seasonal status in Cuba, where Gundlach says that it disappears towards the end of August and does not return until February. What becomes of it in the intervening months remains an unexplained mystery, since it is a species scarcely known outside of its recognized breeding-range. Mr. Read has also had the good fortune to find it breeding. The nest appears to be built in an old woodpecker's-hole in a bottle-palm or pine-tree, and the four or five white eggs are laid in May.

115. *Setophaga ruticilla* (Linnaeus). REDSTART.

*Muscicapa ruticilla* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Setophaga ruticilla* CORY, Cat. W. Indian Birds, 1892, 120 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 211 (I. of Pines, March; Poey's record).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45 (Santa Barbara).

"American Redstart" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVI, 1909, 58, 75 (I. of Pines; XXVII, 1910, 5 (Nuevas River), 15 (I. of Pines; migr.); XXVIII, 1911, 5 (Santa Barbara Mountain, etc.), 7 (Cañada Mountains, etc.; migr.), 113 (West McKinley); XXX, 1913, 123 (McKinley), 130 (I. of Pines, winter).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

Six specimens: Los Indios.

A bird shot December 5 presents a curious case of asymmetrical development. It is a male in first winter plumage, in which the remiges and rectrices on one side are marked with pale orange, as in the adult, while the corresponding markings on the other side are yellow, as is normal at this stage.

The Redstart is very common as a winter resident throughout the island. Although Gundlach says that in Cuba it is one of the first species to arrive in the fall migration, it so happens that the earliest records for that season in the Isle of Pines are all in October (October 16, 1909; October 11, 1910; October 8, 1912). In the spring of 1913 it was observed at Siguanea up to April 25. Its haunts and habits in its winter home are very similar to those in summer, except that it has no song. It seemed to be particularly fond of the mangrove-growths along the Los Indios and Majagua Rivers, while in the vicinity of Nueva Gerona it frequented the bushy thickets on the sides of the Caballos Mountains.

**116. *Geothlypis trichas trichas* (Linnæus). MARYLAND YELLOW-THROAT.**

*Sylvia trichas* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *fide* Gundlach).

*Geothlypis trichas* CORY, Cat. W. Indian Birds, 1892, 119 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 73 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, *ex* Poey; *crit.*).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

"Maryland Yellow-throat" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, December).—READ, Oölogist, XXVI, 1909, 58, 75 (I. of Pines); XXVII, 1910, 5 (Nuevas River), 15 (I. of Pines; migr.).

"Florida Yellow-throat" READ, Oölogist, XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 7 (I. of Pines, October 1), 113 (West McKinley, winter); XXX, 1913, 123 (McKinley), 127 (Santa Barbara), 130 (I. of Pines, winter).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

*Geothlypis trichas ignota* (not of Chapman) READ, Bird-Lore, XIII, 1911, 44 (McKinley); XVI, 1914, 50 (Santa Barbara).

Twelve specimens: Majagua River, Los Indios, Bibijagua, and Nueva Gerona.

After careful comparison of the adult birds of this series I refer them all without hesitation to true *trichas*, and not to *ignota*, to which Messrs. Bangs and Zappey intimate the Isle of Pines birds may prove to belong, since a series of Yellow-throats from western Cuba were so identified by Mr. Ridgway. The color of the flanks is a little

browner than Bahaman specimens comparable as to season, but not more so than in winter skins from Central America. Three males and a female shot April 5 and 8 are just completing the prenuptial moult, as shown by the fresh feathers on the throat.

A common winter resident, according to Mr. Link's experience, throughout the northern part of the island, but not observed in the Cienaga or on the "south coast." It was recorded by Poey, but curiously enough Mr. Zappey did not chance to meet with it. Mr. Read's earliest fall records are October 1, 1910, and October 3, 1909, while Mr. Link's last specimen was shot April 8. Here, as at the north, it is an inhabitant of the low, wet thickets, where it contrives to keep well concealed.

**117. *Teretistris fernandinæ* (Lembeye). FERNANDINA WARBLER.**

*Helmitheros blandus* (not of Lichtenstein) POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).

*Teretistris fernandinæ* CORY, Cat. W. Indian Birds, 1892, 119 ("Pine Island," in geog. distr.).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 649 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (Pasadita and Cayo Bonito).—SHARPE, Hand-List Birds, V, 1909, 113 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVI, 1909, 190 (I. of Pines); XXVIII, 1911, 7 (Cañada Mountains, etc.), 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45 (Santa Barbara).—READ, Oölogist, XXX, 1913, 130 (I. of Pines).

"'Chillina' Warbler" READ, Oölogist, XXVIII, 1911, 5 (Santa Barbara Mountain, etc.), 11 (Nuevas River), 113 (West McKinley).

Eight specimens: Siguatepeque and Los Indios.

A species peculiar to western Cuba, whence it extends to the Isle of Pines, having been recorded by Poey many years ago. Mr. Zappey secured it at Pasadita and Cayo Bonito, while Mr. Link found it not uncommon in the western end of the Cienaga, near Siguatepeque. It was noted at Los Indios also, and at Hato on the "south coast," while Mr. Read has observed it occasionally in the northwestern part of the island. It is a "ground" warbler, keeping to the densest covert in the thick, damp woods, where it is naturally difficult to observe and still more difficult to shoot. Nothing is yet on record regarding its nesting so far as the Isle of Pines is concerned.

**[*Seiurus motacilla* (Vieillot). LOUISIANA WATER-THRUSH.**

(?) "Louisiana Water-Thrush" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, December 14).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River), 15 (I. of Pines; migr.); XXVIII, 1911, 7 (I. of Pines, September 30), 113 (West McKinley); XXX, 1913, 130 (I. of Pines, January).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Seiurus motacilla* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara, December 25).

From an examination of the available evidence it would appear that this water-thrush is much the rarer of the two in the West Indies, the general trend of its migration, according to Prof. W. W. Cooke, being southwestward. Mr. Link did not detect it in the Isle of Pines, and Mr. Read's records above cited constitute the sole basis for its supposed occurrence. In reply to an inquiry he writes that his identifications were based on specimens taken from time to time, but unfortunately not preserved. As he is admittedly not quite clear in discriminating between the two species, however, it is deemed wise to delay the admission of the present species to the list until specimens can be examined. Mr. Read considers it to be a winter resident, arriving the latter part of August (August 24, 1909; August 21, 1911; August 29, 1913), and remaining through March or into April, April 4, 1910, being the latest recorded date in the spring.]

118. *Seiurus noveboracensis notabilis* Ridgway. GRINNELL WATER-THRUSH.

*Seiurus noveboracensis* (not of Gmelin) POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 119 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 72 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, March; Poey's record).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).

"Water-Thrush" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, December 15).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River), 14 (I. of Pines; migr.); XXVIII, 1911, 7 (I. of Pines, October), 113 (West McKinley, December); XXX, 1913, 127 (Santa Barbara), 130 (I. of Pines, January).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

Four specimens: Los Indios.

Although Prof. Cooke, in discussing the winter range of the Water-Thrush (*Bulletin Biological Survey*, No. 18, 1904, 103) says that the West Indian records "unquestionably relate to the eastern bird," I would refer the four specimens from the Isle of Pines before me to *notabilis* with but little hesitation. These were shot between September 30 and November 16 at Los Indios, where the species was found to be common, as well as at Siguanea, frequenting the bushy mangroves along the water's edge. At this latter locality it was recorded as late as the first of May, while Mr. Read has noted its arrival in his district in the fall movement as early as August 20 (1909). It is included in the lists of both Poey, Cory, and Gundlach, and was noted also by Mr. Zappey on his first trip to the island.

119. *Seiurus aurocapillus* (Linnæus). OVEN-BIRD.

"Oven-bird" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, February).  
 —READ, Oölogist, XXVI, 1909, 102 (I. of Pines); XXVII, 1910, 15 (I. of Pines, October 24); XXVIII, 1911, 113 (West McKinley); XXX, 1913, 130 (I. of Pines, winter).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).  
*Seiurus aurocapillus* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

One specimen, Nueva Gerona.

The Oven-bird is a winter resident in the Isle of Pines, but apparently is not common. Mr. Link saw a few at the foot of the Caballos Mountains, securing a single specimen on February 27. Mr. Read has noted it on various occasions at this season, and it is known as a regular and common winter resident throughout the Greater Antilles.

120. *Dendroica palmarum palmarum* (Gmelin). PALM WARBLER.

*Dendroica palmarum* CORY, Cat. W. Indian Birds, 1892, 118 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1893, 67 (I. of Pines).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

*Dendroica palmarum palmarum* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, March; Cory's record).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).

"Palm Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, January).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River), 15 (I. of Pines; migr.), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 7 (I. of Pines, October 2), 113 (West McKinley, winter); XXX, 1913, 123 (McKinley).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

"Yellow Palm Warbler" READ, Oölogist, XXVI, 1909, 224 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 114 (West McKinley); XXX, 1913, 127 (Santa Barbara), 130 (I. of Pines, winter).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

*Dendroica palmarum hypochrysea* (not of RIDGWAY) READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

Nine specimens: Los Indios, Nueva Gerona, and Hato.

This warbler is possibly the most abundant of all those which visit the Isle of Pines during the winter months. It occurs in scattered flocks, frequenting the more open situations, groves of bottle-palms and margins of thickets, keeping on or near the ground. Mr. Read has noted it as early as September 25, and Mr. Link's specimens were all shot between September 30 and April 17, dates which correspond very well with the records of the migration of the species from nearby regions, as given by Prof. Cooke. A young bird taken February 20 shows no sign of moult, although sundry specimens from other sections



are undergoing prenuptial moult at this season. Another example shot April 17, however, is in moult, and has almost completed the chestnut cap.

As *Dendroica palmarum hypochrysea* is merely a straggler in the winter season south of Florida, and as it is practically impossible for any one, even an expert, to distinguish it in the field from true *palmarum* with any degree of certainty, I refer all of Mr. Read's records to *D. palmarum*.

**121. *Dendroica discolor* (Vieillot). PRAIRIE WARBLER.**

*Sylvia discolor* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Dendroica discolor* CORY, Cat. W. Indian Birds, 1892, 118 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 70 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, *ex* PoeY).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).

"Prairie Warbler" READ, Forest and Stream, LXXXIII, 1909, 452 (I. of Pines, December).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 7 (I. of Pines, November), 113 (West McKinley); XXX, 1913, 131 (I. of Pines, December).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

Twenty-two specimens: Los Indios, Nueva Gerona, Bibijagua, and Caleta Grande.

A common winter resident, of which the first specimen was taken on September 26, and the last on April 19, these dates probably including the usual average time of its stay. Mr. Read recorded it in 1915, however, as late as April 28. Only a few of the series secured appear to be adult, brightly colored birds, comparable with those from the southern United States, Porto Rico, etc. The balance seem to be immature; at any rate, they are dull and dark-colored, and many of them show considerable gray on the sides of the head, while the superciliaries also are dull-colored. Some of these birds, too, are so worn as to suggest that they had but recently been breeding, but this is of course exceedingly improbable. The favorite haunts of this species in the Isle of Pines are in tracts of low scrub and brushy places, where it contrives to keep well hidden, dodging about close to the ground.

**122. *Dendroica striata* (Forster). BLACK-POLL WARBLER.**

"Black-poll Warbler" READ, Oölogist, XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

Three specimens: Caleta Cocodrilos and Los Indios.

These were all shot in low brush, on April 24 and May 7 respectively, the latter a later date than is recorded by Gundlach for Cuba. The first ones taken were in very poor condition, and one of these shows a few yellowish feathers below, evidently left over from a previous plumage. Mr. Read has seen birds in the fall migration which he has identified as belonging to the present species.

123. *Dendroica dominica dominica* (Linnæus). YELLOW-THROATED WARBLER.

*Sylvia pensilis* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Dendroica dominica* CORY, Cat. W. Indian Birds, 1892, 118 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 69 (I. of Pines).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

*Dendroica dominica dominica* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 578 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, March; Poey's record).

"Yellow-throated Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, January).—READ, Oölogist, XXVI, 1909, 58, and XXVIII, 1911, 7 (I. of Pines), 3 (Santa Barbara Mountain, etc.).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) "Sycamore Warbler" READ, Oölogist, XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines, October 20).

Twelve specimens; Los Indios.

A winter resident, fairly common, having been first recorded by Poey many years ago, and later by Messrs. Zappey, Read, and Link. The latter observer did not notice it, however, except in the vicinity of Los Indios, where it was rather numerous from September 19 to December 18. The series secured includes several birds of the year, readily distinguishable by their paler colors and yellowish or brownish wash below, especially on the flanks. Two of these immature birds have rather small bills and practically white superciliaries, and might readily be referred to *D. d. albilora*, while others are intermediate in these respects. All immature specimens of typical *D. dominica* before me have decidedly yellow superciliaries, so that the birds in question look very suspicious, coming as they do from a locality not far remote from the winter home of *D. d. albilora*.

No unquestioned migration dates for this warbler for the Isle of Pines are on record thus far. It is known to leave its summer home very early, however, usually in July, and to pass northward again in March. While in the island it seems to prefer the palms, keeping rather high up.

**[*Dendroica fusca* (Müller). BLACKBURNIAN WARBLER.]**

(?) "Blackburnian Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, December 8).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVIII, 1911, 113 (West McKinley); XXX, 1913, 131 (I. of Pines, December 8).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Dendroica blackburniæ* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

In view of the fact that the Blackburnian Warbler is unknown in the West Indies proper, and has occurred but twice as an accidental visitor during migration in the Bahamas, it is scarcely necessary to discuss the reasons for treating Mr. Read's record of a bird *seen* in December as doubtful.

***Dendroica cerulea* (Wilson). CERULEAN WARBLER.**

(?) "Cerulean Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, February).—READ, Oölogist, XXVI, 1909, 75 (I. of Pines); XXVIII, 1911, 113 (West McKinley); XXX, 1913, 131 (I. of Pines, February 11).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Dendroica cerulea* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

This is another species of warbler which habitually avoids the West Indian islands in migration, the few records we have from there falling within the category of accidental occurrences. Mr. Read says that he secured a specimen on February 11, 1909, but as it is not now extant it seems better to leave the record for the present in the doubtful column.]

**124. *Dendroica virens* (Gmelin). BLACK-THROATED GREEN WARBLER.**

*Sylvia virens* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Dendroica virens* GUNDLACH, Contr. Orn. Cubana, 1876, 64 (I. of Pines).—CORY, Cat. W. Indian Birds, 1892, 118 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 62 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 562 (I. of Pines, in geog. distr.).—COOKE, Bull. Biol. Survey, No. 18, 1904, 87 (I. of Pines, *ex* Cory).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, *ex* Poey and Gundlach).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

"Black-throated Green Warbler" READ, Oölogist, XXVI, 1909, 224 (I. of Pines); XXVII, 1910, 15 (I. of Pines, October); XXVIII, 1911, 114 (West McKinley, October); XXX, 1913, 131 (I. of Pines, October).—READ, I. of Pines News, VI, Feb. 14, 1914, (I. of Pines).

Although there are only a few scattering records for this warbler in the West Indies, its place on the list of Isle of Pines birds is apparently secure. Poey refers to it as having been observed by Gundlach near Nueva Gerona, and Gundlach himself says that his first specimen of the species was taken in the island in January, 1855 (*lege* 1854). This record, which has been quoted by other authors, was apparently the only basis for attributing the present species to the island until recently, when Mr. Read has reported its occurrence at West McKinley

on October 21, 26, and 28, 1909, a specimen having been shot on the last date. His note-book also contains a record of several seen on November 18, 1912.

125. *Dendroica coronata* (Linnæus). MYRTLE WARBLER.

"Myrtle Warbler" READ, *Oölogist*, XXVI, 1909, 224 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 114 (West McKinley); XXX, 1913, 131 (I. of Pines; migr.).

*Dendroica coronata* READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

While the above records by Mr. Read may perhaps be open to the same criticism as certain others of his published observations, there can be no question as to the probability of the occurrence of this warbler in the Isle of Pines as a winter resident, since it is well known to be common at that season in the Bahamas and all of the Greater Antilles. Mr. Link, however, did not meet with it during his stay.

126. *Dendroica cærulescens cærulescens* (Gmelin). BLACK-THROATED BLUE WARBLER.

*Sylvia cærulescens* POEY, *Mem. Hist. Nat. Cuba*, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Dendroica cærulescens* CORY, *Cat. W. Indian Birds*, 1892, 118 (I. of Pines, in geog. distr.).—GUNDLACH, *Orn. Cubana*, 1895, 63 (I. of Pines).—BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 210 (I. of Pines, March; Poey's and Cory's records).—READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

*Dendroica cærulescens cærulescens* RIDGWAY, *Bull. U. S. Nat. Mus.*, No. 50, II, 1902, 541 (I. of Pines, in geog. distr.).

"Black-throated Blue Warbler" READ, *Forest and Stream*, LXXXIII, 1909, 452 (I. of Pines, January).—READ, *Oölogist*, XXVI, 1909, 58, and XXVII, 1910, 15 (I. of Pines, winter); XXVIII, 1911, 7 (I. of Pines; migr.), 113 (West McKinley); XXX, 1913, 130 (I. of Pines, winter).—READ, *I. of Pines News*, VI, Feb. 14, 1914 (I. of Pines).

Four specimens: Caleta Grande, Los Indios, and Nueva Gerona.

Common as a winter resident, frequenting the thicker covert, and usually keeping rather low down. It was found to be particularly numerous on the wooded slopes of the Caballos Mountains, where it was observed as late as the third week in May. No dates for its arrival in the fall migration are available, nor do any such seem to be on record for any of the West Indies thus far. Mr. Link's first specimen was shot November 30. Mr. Read says that while this warbler was very common in his section in December, 1908, none were seen during the winter of 1909-10.

***Dendroica tigrina* (Gmelin). CAPE MAY WARBLER.**

(?) "Cape May Warbler" READ, *Oölogist*, XXX, 1913, 131 (I. of Pines, March 25, 1911).

This is one of the characteristic, if less common, winter-resident warblers throughout the West Indies, and while its occurrence as such in the Isle of Pines is entirely probable, Mr. Read's identification is unfortunately not susceptible of verification.

***Dendroica magnolia* (Wilson). MAGNOLIA WARBLER.**

(?) "Magnolia Warbler" READ, *Forest and Stream*, LXXIII, 1909, 452 (I. of Pines, December).—READ, *Oölogist*, XXVI, 1909, 58 (I. of Pines); XXVIII, 1911, 113 (West McKinley).—READ, *I. of Pines News*, VI, Feb. 14, 1914 (I. of Pines).

*Dendroica maculosa* READ, *Oölogist*, XXVIII, 1911, 12 (I. of Pines).

In discussing the winter range of the present species Prof. Cooke (*Bulletin Biological Survey*, No. 18, 1904, 66) says that "there is no positive record of the occurrence in either" the Bahamas or Cuba. It is thus probable that Mr. Read, who claims to have observed "a few" on December 12, 1908, was mistaken in his identification.

**127. *Dendroica petechia gundlachi* Baird. CUBAN YELLOW WARBLER.**

*Sylvia petechia* (not of Linnæus) POEY, *Mem. Hist. Nat. Cuba*, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Dendroica petechia gundlachi* CORY, *Cat. W. Indian Birds*, 1892, 118 (I. of Pines, in geog. distr.).—READ, *Bird-Lore*, XVI, 1914, 50 (Santa Barbara).—READ, *I. of Pines News*, VI, Apr. 25, 1914 (Pine River).

*Chrysocantor petechia gundlachi* BANGS & ZAPPEY, *Am. Nat.*, XXXIX, 1905, 210 (I. of Pines, *ex* Poey and Cory).

"Mangrove Warbler" READ, *Oölogist*, XXX, 1913, 130 (I. of Pines), 168 (Los Indios).—READ, *I. of Pines News*, VI, Feb. 14, 1914 (I. of Pines).

Eight specimens: Los Indios, Bird Island, Majagua River, and Siguanea.

These prove upon comparison to be fairly distinct from specimens from the Bahama Islands (*D. p. flaviceps*) and Porto Rico (*D. p. cruciana*), being much darker and more greenish than either. Several younger females, with white and gray feathers intermixed, are included.

This is a bird of the mangroves, to which it is apparently exclusively confined. It is accordingly most numerous along the coast and about the islands of Siguanea Bay, where the mangroves are so constant and pronounced a feature. Mr. Read has observed it along the Pine River also, but it is apparently a rare bird in the northern part of the island, judging from the dearth of records, and, indeed, it cannot be called a common bird at any locality as yet visited. Two nests were found, both in mangroves within a few feet of the water, during the third week in April, but as yet without eggs.



128. *Compsothlypis americana usneæ* Brewster. NORTHERN PARULA WARBLER.

*Sylvia americana* (not *Parus americanus* Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 426 (I. of Pines, *fide* Gundlach).

*Compsothlypis americana* CORY, Cat. W. Indian Birds, 1892, 117 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 210 (I. of Pines, March; Poey's record).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).

*Parula americana* GUNDLACH, Orn. Cubana, 1895, 57 (I. of Pines).

"Parula Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, January).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 5 (Nuevas River), 15, and XXVIII, 1911, 7 (I. of Pines; migr.), 113 (West McKinley, winter); XXX, 1913, 130, 131 (I. of Pines).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

Five specimens: Los Indios.

This dainty warbler was noted several times by Mr. Link at Los Indios from September 25 to November 20, but was not encountered elsewhere. From other available sources we learn, however, that it is a regular winter resident in the island, as elsewhere in the West Indies. It has been so recorded by Mr. Read, and was noted in March, 1902, by Mr. Zappey, but how much later in the season it remains is an undetermined question. The specimens brought back appear referable to the present form, but the colors both above and below are overlaid with paler feather-tips.

*Vermivora bachmani* (Audubon). BACHMAN WARBLER.

(?) "Bachman Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, February 6).—READ, Oölogist, XXVI, 1909, 58, and XXX, 1913, 131 (I. of Pines); XXVIII, 1911, 113 (West McKinley).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Helminthophila bachmanii* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

This rare warbler is known to winter in Cuba, and may extend its migration to the Isle of Pines as well. Mr. Read says that he took a specimen on February 6, 1909, but as the example in question is unfortunately not now in existence, and a mistake might very readily be made in a case like this, it would seem best to keep the species in the hypothetical list for the present.

*Vermivora peregrina* (Wilson). TENNESSEE WARBLER.

(?) "Tennessee Warbler" READ, Oölogist, XXVI, 1909, 224 (I. of Pines); XXVII, 1910, 15, and XXVIII, 1911, 7 (I. of Pines; migr.), 114 (West McKinley); XXX, 1913, 131 (I. of Pines; migr.).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Helminthophila peregrina* READ, Oölogist, XXVIII, 1911, 13 (I. of Pines).

This is another species the occurrence of which in the Isle of Pines is problematical, since it is merely casual or accidental as a migrant in the West Indies. Mr. Read writes that he secured a specimen, but as it is not now extant to authenticate his record, it is, I think, inadmissible under the circumstances.

**Protonotaria citrea** (Boddaert). PROTHONOTARY WARBLER.

(?) "Prothonotary Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, January 25).—READ, Oölogist, XXVI, 1909, 58, and XXX, 1913, 131 (I. of Pines); XXVIII, 1911, 113 (West McKinley).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

(?) *Protonotaria citrea* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

This species is entered on Mr. Read's list on the strength of a single example (which he writes me was secured, but not preserved) recorded under date of January 25, 1909. There must be some mistake here, since this warbler is well known to avoid the West Indies during migration, and in any case the date of the supposed occurrence would argue against the correctness of the identification, since the species is not known to winter north of Nicaragua.

**Helmitheros vermivorus** (Gmelin). WORM-EATING WARBLER.

(?) "Worm-eating Warbler" READ, Oölogist, XXVIII, 1911, 13, and XXX, 1913, 131 (I. of Pines).—READ, I. of Pines News, VI, Feb. 14, 1914 (I. of Pines).

The Worm-eating Warbler is said to be a regular winter resident in Cuba, so that there is no intrinsic reason why it should not occur in the Isle of Pines also. The above records apparently all refer to an individual which Mr. Read reports that he shot on January 9, 1910, the specimen being subsequently lost.

129. **Mniotilta varia** (Linnæus). BLACK AND WHITE WARBLER.

*Mniotilta varia* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 117 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 57 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 209 (I. of Pines, March; Poey's record).—READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara). "Black and White Warbler" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines, December).—READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 15 (I. of Pines; migr.); XXVIII, 1911, 7 (I. of Pines, October), 113 (West McKinley); XXX, 1913, 127 (Santa Barbara), 131 (I. of Pines, winter).

Two specimens: Los Indios and Nueva Gerona.

This warbler occurs as a regular winter resident, is generally distributed, but apparently not very common. The earliest record for its arrival in the fall migration is August 23 (1909), according to Mr. Read, but doubtless the bulk arrive later, probably in October. Mr. Link's latest spring date for this species was May 5. During its stay it is apt to occur almost anywhere in the woodland, and was found in the mangroves on at least one occasion.

130. *Dolichonyx oryzivorus* (Linnæus). BOBOLINK.

*Dolichonyx oryzivorus* CORY, Cat. W. Indian Birds, 1892, 110 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 117 (I. of Pines).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 213 (I. of Pines, ex Cory and Gundlach).  
 "Bobolink" READ, Oölogist, XXVIII, 1911, 7, 13, and XXX, 1913, 131 (I. of Pines; migr.).

An abundant migrant throughout the West Indies, although actually recorded from the Isle of Pines on but a few occasions. Gundlach casually refers to its occurrence there, and it is included in Mr. Cory's list as found in the island, doubtless on the authority of Gundlach. Mr. Read says that he observed a flock of twenty birds on May 9, 1910, which were gone by the next day, and a few also in the fall migration, on September 24 of the same year.

131. *Sturnella magna hippocrepis* (Wagler). CUBAN MEADOWLARK.

*Sturnella hippocrepis* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).—CORY, Cat. W. Indian Birds, 1892, 110 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 121 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 368 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 212 (Santa Fé, Jucaro, and Cayo Bonito; crit.).—READ, Oölogist, XXVI, 1909, 102 (syn.); XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).  
 "Meadowlark" READ, Oölogist, XXVI, 1909, 58 (I. of Pines); XXVII, 1910, 84 (McKinley to Nueva Gerona); XXX, 1913, 122 (McKinley; habits).  
 "Cuban Meadowlark" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVII, 1910, 5 (Nuevas River), 42 (I. of Pines; nesting); XXVIII, 1911, 3 (McKinley), 6, 11 (Nuevas River), 7 (Cañada Mountains, etc.), 113 (West McKinley); XXX, 1913, 123 (McKinley and Nuevas River), 125, 127 (Santa Barbara), 130 (I. of Pines), 168 (Los Indios).

Seventeen specimens: Bibijagua and Los Indios.

Mr. Chapman (*Bulletin American Museum of Natural History*, IV, 1892, 305) contends that *hippocrepis* is more closely allied to *neglecta* than to any other form of the genus, and Mr. Ridgway has so far indorsed this view as to accord the former specific rank. I confess that after a study of this fine series in connection with ample and comparable material from other sections I fail to find the slightest justification for such an arrangement. As a matter of fact, *hippocrepis* is so close to its nearest geographical representative, *argutula* of southern Florida (as later admitted by Mr. Chapman himself—*cf. Bulletin American Museum of Natural History*, XIII, 1900, 300) that it is often difficult properly to assign a given specimen by virtue of its

characters alone. The yellow of the throat in *hippocrepis* does not invade the malar region to any more appreciable extent than is shown by Florida birds, although it is apparently on this character that Mr. Ridgway has mainly relied to place it near *neglecta*. Specimens in full plumage are quite as dark as Florida birds, but differ in averaging smaller, with the under parts more conspicuously streaked. The present form should stand, therefore, as an insular race of *S. magna*.

A characteristic bird of the open country in the Isle of Pines, frequenting the pastures, fields, and edges of the pine-woods, wherever there is a growth of low grasses or herbage, and the ground is dry. It is generally distributed in such situations over the entire northern part of the island, but is absent from the Cienaga and the country to the southward, where the conditions are unsuitable. During the breeding-season, or from March to June inclusive, it is seen in pairs, after which the young and old associate in family groups. Young in juvenal dress were taken at Bibijagua on July 5 and 10. Its notes are decidedly weaker than those of the northern Meadowlark, and it is a much tamer bird.

132. *Agelaius assimilis* Lembeye. CUBAN RED-WING.

*Agelaius assimilis* CORY, Cat. W. Indian Birds, 1892, 127 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 120 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 342 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 212 (Cienaga; habits; plum.; crit.).—SHARPE, Hand-List Birds, V, 1909, 493 (I. of Pines, in geog. distr.).—READ, Oölogist, XXX, 1913, 131 (I. of Pines).

*Agelaius subniger* BANGS, Proc. New England Zool. Club, IV, 1913, 92 (Cienaga; orig. descr.; type in coll. Mus. Comp. Zool.; meas.; crit.).—STONE, Auk, XXX, 1913, 453, in text (review).

"Cuban [Red]-wing" READ, Oölogist, XXX, 1913, 130 (Santa Barbara).

Fourteen specimens: Siguanea and Pasadita.

In addition to the present series of this rare species, I have been able to examine in this connection the specimens from Cuba and the Isle of Pines handled by Mr. Bangs, and upon the strength of which he separated the bird from the latter island under the name *Agelaius subniger*. Upon the status of this alleged form this new material throws considerable light. Taking up the males first, it appears that they naturally fall into two series, unquestionably representing different ages. The fully adult males are deep glossy black above and below, with the lesser wing-coverts crimson, and the greater wing-coverts buffy, as in *A. phæniceus*. In first nuptial dress, however,

the general coloration is much duller and browner, and the red area on the wing-coverts is also duller and much mixed with black, which in some cases spreads over all of these feathers except the innermost. All but one of the male specimens from the Isle of Pines in the Bangs Collection, as it turns out, are clearly in this immature stage, and the exception (No. 13,366) is *probably* immature also, having some black on the wing-coverts, and being considerably worn, like the others. On the other hand, the Cuban males are all fully adult birds, in nowise different, so far as color is concerned, from adults from the Isle of Pines, with which they have been directly and carefully compared. The culmen is slightly flatter, it is true, in the Cuban specimens, but I believe that even this difference would disappear in a large series; at any rate, it is certainly too trifling a difference upon which to base the recognition of even a subspecies.

The type of *A. subniger* is a female, and is obviously browner than Cuban females, but I am by no means sure that this is not the result of wear and fading, since I cannot discern any such striking difference between the latter and the series of Isle of Pines females collected by Mr. Link. This being the case, there would seem to be but one course open: to treat *A. subniger* as a pure synonym of *A. assimilis*, since it is clear that Mr. Bangs was misled by the circumstance of having only immature examples of the bird for comparison.

This species has a very restricted range, being known only from the Zapata Swamp in Cuba and the Cienaga in the Isle of Pines. Mr. Zappey's specimens were all shot in the eastern end of the Cienaga, probably not far from Pasadita, in April, 1904. At this season all the birds of this species from that vicinity were gathered into one flock, which kept to some large trees at the edge of the swamp. From the fact that the testes of the males were not enlarged, nor any very young birds seen, he inferred that the breeding-season was not near at hand nor recently over. As above noted, the examples he secured were all (with one possible exception) immature, in first nuptial plumage, and their development may not have been so rapid. At any rate, the birds which Mr. Link found at Pasadita a month later in the season, or during the latter part of May, were apparently all breeding at the time, being always found in pairs. One nest was discovered, built in the high grass at the edge of the swamp, about a foot above the water. It was constructed of grasses and fastened to the surrounding stems after the fashion of the Red-winged Blackbird of the north;



the eggs had not yet been laid. The species could not be called common, and the pairs were scattered. It was noted also in the Cienaga at Siguanea in small numbers in October and April, and one specimen was secured. Mr. Read claims to have observed it in the Santa Barbara tract in September, and it is reported from the island by Cory and Gundlach. Its notes "resemble those of the common Red-wing (*Agelaius phœniceus*), but are lower and more wheezy, sounding, when a number are calling together, much like the chirping of insects" (Bangs & Zappey).

133. *Icterus hypomelas* (Bonaparte). CUBAN ORIOLE.

*Xantornis dominicensis* (not *Oriolus dominicensis* Linnæus) POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Icterus hypomelas* CORY, Cat. W. Indian Birds, 1892, 110 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat. XXXIX, 1905, 211 (Jucaro, El Hospital, Cayo Bonito, and Santa Fé; habits; crit.).—READ, Oölogist, XXVI, 1909, 102 (I. of Pines), 148 (I. of Pines; habits); XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, I. of Pines News, VI, Dec. 13, 1913 (descr.; habits).

"Cuban Oriole" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).—READ, Oölogist, XXVII, 1910, 5 (Nuevas River), 84 (McKinley to Nueva Gerona); XXVIII, 1911, 3 (McKinley), 5 (Santa Barbara Mountain, etc.), 6, 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (McKinley), 125, 130 (Santa Barbara).

Twenty-four specimens: Nueva Gerona, Bibijagua, and Los Indios.

As described by Mr. Ridgway (*Birds of North and Middle America*, II, 1902, 271), male birds in first nuptial plumage average brighter, and with more black on the head, throat, and posterior under parts than females at this stage. In juvenal dress both sexes are like the second-year female, but are still duller and browner, the black of the head scarcely or not indicated. Examples shot June 26 and July 6 are in this stage; some of those at the latter date, however, show postjuvénal moult. Adult males average more yellow on the crissum than adult females. Messrs. Bangs and Zappey remark that "in birds from the Isle of Pines the yellow color of [the] rump, thighs, and wing-coverts is a little paler than in Cuban examples, as is also the brownish yellow of [the] under tail-coverts and anal region, with less of this color and rather more black than in Cuban specimens; but these differences are not very tangible and the Isle of Pines bird is not different enough to be formally separated as a subspecies."

A very common and generally distributed species, inhabiting the thick woods as well as the palm and citrus-fruit groves, and often coming familiarly to the vicinity of houses, to feed in the gardens and among the vines. Several nests were found near Nueva Gerona, all in the tops of palm trees, attached to the under side of the broad leaves. This was during the first and second weeks in June. Young birds were on the wing the latter part of June, accompanied by their parents, and such family groups appeared to hold together until the following breeding-season. "The oriole feeds a good deal among the flowers of various shrubs and trees, and its head is often daubed with juice and pollen from these." (Bangs & Zappey).

134. *Ptiloxena atrovioacea* (D'Orbigny). D'ORBIGNY BLACKBIRD.  
*Quiscalus atro-violaceus* POEY, Mem. Hist. Nat. Cuba, 1854, 427 (Nueva Gerona, *vide* Gundlach).  
*Dives atroviolaceus* CORY, Cat. W. Indian Birds, 1892, 111 (I. of Pines, in geog. distr.).—GUNDLACH, Orn. Cubana, 1895, 123 (I. of Pines).  
*Ptiloxena atrovioacea* RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 252 (I. of Pines, in geog. distr.).—BANGS & ZAPPEY, Am. Nat. XXXIX, 1905, 211 (I. of Pines, *ex* Poey and Gundlach).—SHARPE, Hand-List Birds, V, 1909, 507 (I. of Pines, in geog. distr.).—READ, Oölogist, XXVI, 1909, 190 (I. of Pines); XXVII, 1910, 5 (Nuevas River); XXVIII, 1911, 12 (I. of Pines), 114 (West McKinley); XXX, 1913, 131 (I. of Pines).  
 (?) "Rusty Blackbird?" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).  
 —READ, Oölogist, XXVI, 1909, 58, and XXVIII, 1911, 12 (I. of Pines), 113 (West McKinley).

This is said to be a common species in Cuba, but it must be much less numerous in the Isle of Pines, since, while given by Gundlach as a native of the island, it was not encountered there by either Mr. Zappey or Mr. Link, although Mr. Read claims to have observed it on sundry

part (I. of Pines, in geog. distr.).—READ, Oölogist, XXVI, 1909, 190 (I. of Pines); XXVIII, 1910, 15 (syn.); XXVIII, 1911, 12 (I. of Pines).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).—READ, I. of Pines News, V, Nov. 15, 1913 (descr.; habits).

"Grackle" READ, Oölogist, XXVI, 1909, 58, and XXVIII, 1911, 13 (I. of Pines).

"Florida Grackle" (error!) READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines).

*Quiscalus quiscula aglæus* (not of Baird) READ, Oölogist, XXVI, 1909, 101 (I. of Pines; habits).

"Cuban Grackle" READ, Oölogist, XXVII, 1910, 5 (Nuevas River), 42 (I. of Pines; nesting), 84 (McKinley to Nueva Gerona), XXVIII, 1911, 3 (McKinley), 6, 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (McKinley and Nuevas River), 125, 127, 130 (Santa Barbara), 168 (Los Indios).

Twenty-five specimens: Bibijagua, Los Indios, and Nueva Gerona.

*Type*, No. 41, 199, Collection Carnegie Museum, adult male; Nueva Gerona, Isle of Pines, February 28, 1913; Gustav A. Link.

*Subspecific characters*.—Similar in general to *Holoquistus caymanensis caymanensis* (Cory), but of larger size, and the gloss of the plumage in the adult male almost entirely steel-blue, without any purplish tinge.

In the following table of measurements of this and allied forms only adult males have been included.

*Holoquistus caymanensis caymanensis*:

No.	Locality.	Wing.	Tail.	Bill.
111185 <sup>19</sup>	Grand Cayman.....	135	113	30
30019 <sup>20</sup>	Grand Cayman.....	134	112	30
30015 <sup>20</sup>	Grand Cayman.....	135	114	30
30034 <sup>20</sup>	Grand Cayman.....	138	117	29
30055 <sup>20</sup>	Grand Cayman.....	135	119	28
30045 <sup>20</sup>	Grand Cayman.....	133	112	31

*Holoquistus caymanensis dispar*:

39859 <sup>21</sup>	Los Indios, I. of Pines.....	145	128	32
39893 <sup>21</sup>	Los Indios, I. of Pines.....	138	118	31.5
41199 <sup>21</sup>	Nueva Gerona, I. of Pines.....	143	123	33
41237 <sup>21</sup>	Los Indios, I. of Pines.....	141	120	32.5
41250 <sup>21</sup>	Los Indios, I. of Pines.....	140	119	33
41328 <sup>21</sup>	Los Indios, I. of Pines.....	140	120	33
171414 <sup>19</sup>	El Guama, Cuba.....	139	115	31
171415 <sup>19</sup>	El Guama, Cuba.....	140	124	31.5
171417 <sup>19</sup>	El Guama, Cuba.....	146	121	34
171418 <sup>19</sup>	El Guama, Cuba.....	140	119	33
171419 <sup>19</sup>	El Guama, Cuba.....	140	121	31.5

*Holquiscalus jamaicensis gundlachii*:

1262 <sup>22</sup>	San Carlos (Estate), Guantánamo, Cuba.....	149	129	35
1273 <sup>22</sup>	San Carlos (Estate), Guantánamo, Cuba.....	152	127	35
1369 <sup>22</sup>	San Carlos (Estate), Guantánamo, Cuba.....	152	126	35
57248 <sup>23</sup>	Trinidad, Cuba.....	152	132	33
57249 <sup>23</sup>	Trinidad, Cuba.....	150	129	32
57250 <sup>23</sup>	Trinidad, Cuba.....	152	129	34
57252 <sup>23</sup>	Trinidad, Cuba.....	156	130	33
57253 <sup>23</sup>	Trinidad, Cuba.....	150	126	32
57255 <sup>23</sup>	Trinidad, Cuba.....	150	127	31
57256 <sup>23</sup>	Trinidad, Cuba.....	142	118	35
57257 <sup>23</sup>	Trinidad, Cuba.....	151	132	34
172648 <sup>19</sup>	Guanaja, Cuba.....	149	128	34
177832 <sup>19</sup>	Baracoa, Cuba.....	154	123	35

The Isle of Pines *Holquiscalus*, as represented by the above fine series, was naturally at first referred to the recognized Cuban species, *H. gundlachii*, but the remarks of Messrs. Bangs and Zappey with reference to the variation which obtains in that form led me to look into the matter a little further, with wholly unlooked-for results. In the course of this investigation it became necessary to examine all of the Greater Antillean forms of this genus, which the latest reviser of the group (Ridgway, *Birds of North and Middle America*, II, 1902, 222 *et seq.*) treats as distinct species, apparently on the ground that as insular forms they cannot be expected to intergrade. I have always felt doubt as to the propriety of such an arrangement, and the acquisition of a series of grackles from Porto Rico and the Isle of Pines has been made the occasion for a renewed study of this group, the conclusions from which I present herewith. This study has been made possible only through the loan of a considerable number of specimens from other sources, as elsewhere indicated.

Comparison of the series of adult males from the Isle of Pines with a similar series from Trinidad, on the south coast of Cuba, shows at once that the two series represent entirely distinct forms, differing not only in size (except for the bill), but also in color. In the Isle of Pines specimens the gloss is a dark steel-blue, very pronounced both

<sup>19</sup> Collection U. S. National Museum.

<sup>20</sup> Collection Field Museum of Natural History.

<sup>21</sup> Collection Carnegie Museum.

<sup>22</sup> Collection Charles T. Ramsden.

<sup>23</sup> Collection American Museum of Natural History.

above and below, while in the Trinidad skins it is decidedly purplish or violaceous. These color-differences are very conspicuous when a series of adults are compared, while measurements show that the Isle of Pines birds are constantly smaller. Moreover, specimens from Baracoa, at the eastern extremity of Cuba, and from Guanaja, on the north coast, prove to be the same as the Trinidad birds, while skins from El Guama, in the Province of Pinar del Rio, on the other hand, cannot be distinguished (allowing for their somewhat different condition) from those from the Isle of Pines. It is evident, therefore, that as distinctions go in this genus two different species inhabit the island of Cuba, one the eastern and middle, the other the western portion. The differences here pointed out, while perfectly obvious and constant, seem to have escaped the notice of previous writers on this group, or at least to have been discounted as having any geographical significance. While Messrs. Bangs and Zappey, it is true, speak of the great variation among Cuban birds, they seem not to have suspected that this variation was correlated with locality. The question of names for the two forms naturally comes up for determination at this point. Fortunately, the type of Cassin's *Quiscalus gundlachii* is still extant in the museum of the Academy of Natural Sciences of Philadelphia, and Mr. Witmer Stone has very courteously at my request compared it with material which I forwarded for the purpose. He reports that the type-specimen agrees precisely with the purplish bird. This fixes the name *gundlachii* on the form from eastern Cuba, and leaves that from western Cuba and the Isle of Pines to be provided with a new name, which I here supply. Different as it is from *gundlachii*, it is so closely related to the Grand Cayman form that it is best considered as conspecific. Besides averaging considerably larger than *caymanensis*, it is somewhat different in color, the plumage lacking almost entirely the purplish sheen which is present in that form, although by no means conspicuous. While these differences are, it is true, more or less bridged over by individual variation in both forms, the average difference between the respective series is in my judgment sufficient to entitle the bird of western Cuba and the Isle of Pines to recognition by name.

The form from Grand Cayman is not only decidedly smaller than the forms from eastern Cuba and Jamaica respectively, but also has very little of the purplish gloss of the plumage, so pronounced and characteristic a feature in those forms. The latter agree with each



other so well in their general characters that I propose to unite them as conspecific. Indeed, all the Greater Antillean forms are so closely related that they might be regarded as conspecific without doing violence to the facts in the case, so far as can be judged from the examination of specimens. Whether their habits differ in any essential manner I do not know. The Haitian and Porto Rican forms, too, have so many characters in common that in my judgment they should stand as subspecies of a third specific type. According to my views, arrived at after a careful study and comparison of a series of all the various forms involved, these should stand as follows, the diagnostic characters being based on the adult males alone.

- a.* Body-plumage strongly glossed with dark steel-blue, with little or no violaceous shade.
- b.* Larger; steel-blue gloss more pronounced. (Western Cuba and Isle of Pines).....*Holoquiscalus caymanensis dispar.*
- bb.* Smaller; gloss of plumage with a slight violaceous shade. (Grand Cayman).....*Holoquiscalus caymanensis caymanensis.*
- aa.* Body-plumage strongly glossed with violaceous.
- c.* Violaceous gloss more intense; bill relatively longer and slenderer. (Eastern Cuba).....*Holoquiscalus jamaicensis gundlachi.*
- cc.* Violaceous gloss less intense; bill relatively shorter and stouter. (Jamaica)  
*Holoquiscalus jamaicensis jamaicensis.*
- aaa.* Body-plumage glossed with dark purplish black, especially posteriorly.
- d.* Bill wider, relatively longer, with the tip less strongly decurved. (Haiti)  
*Holoquiscalus niger niger.*
- dd.* Bill more compressed, relatively shorter, with the tip more strongly decurved. (Porto Rico).....*Holoquiscalus niger brachypterus.*

The above seems to me a more logical arrangement than that at present in vogue, but in any case, should one or more of these six forms be held to be of specific value, a due regard for consistency would require all to be so treated. The various forms from the Lesser Antilles would also seem to require revision along the same lines, but I have no occasion to discuss this matter further in the present connection.

The males of the lot from the Isle of Pines are divided readily into two series when regard is had to the amount of glossiness of the general plumage. The less glossy birds closely resemble the fully adult females in color, but are of course larger. These I take to be birds in first nuptial plumage. The females also differ among themselves in a corresponding manner. Most of the specimens from western Cuba which I have seen chance to be in this immature dress; they thus

naturally differ more from eastern Cuban birds than do adults. The Bibijagua specimens, shot July 9 and 10, are in juvenal plumage, while adults, taken October 13 and 14, are just completing the postnuptial moult. The iris is marked as "straw-color" in the male, not brown, as given by Mr. Ridgway for *gundlachii*.

The Grackle is an abundant resident species, traveling in flocks, except in the breeding-season. It is found throughout the island, in the more remote districts as well as in the cultivated sections, frequenting the open country, the vicinity of streams, etc. It has a bad reputation for destroying rice, but is a useful species nevertheless. It follows the plow as does the Crow Blackbird in the north, which species it otherwise resembles in notes and general habits. According to Mr. Read and Mr. Zappey it is wont to alight on the backs of horses and cattle to pick off the ticks with which they are often infested. "The male, owing to the vertically placed feathers in the tail, presents a curious appearance when on the wing." A number of nests in process of construction were found in the Cienaga near Siguanea the last week in April; in every case they were situated in the mangroves, only a few feet above the water, and were built of dry sticks and stems of weeds, lined with fine rootlets. Gundlach says that in Cuba they nest in the palm-trees, sometimes several together, and Mr. Read speaks of having found a nest forty feet up in a "jucaro" tree. The eggs are four or five in number, and are colored like those of the Crow Blackbird.

136. *Spindalis pretrei* (Lesson). CUBAN SPINDALIS.

*Tanagra pretrei* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Spindalis pretrei* CORY, Cat. W. Indian Birds, 1892, 114 (I. of Pines, in geog. distr.).

—GUNDLACH, Orn. Cubana, 1895, 77 (I. of Pines).—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, II, 1902, 68 (I. of Pines; meas.; crit.).—READ, Oölogist, XXVI, 1909, 189, 190 (I. of Pines; descr.; habits); XXVIII, 1911, 12 (I. of Pines).

*Spindalis pretrei pinus* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 213 (Santa Fé, Jucaro, Cayo Bonito, Pasadita, and San Juan; orig. descr.; type now in coll. Mus. Comp. Zool.; meas.; crit.; habits).—ALLEN, Auk, XXII, 1905, 329, in text (review).—EDITORS, Ibis, 1905, 631, in text (review).—SHARPE, Hand-List Birds, V, 1909, 380 (ref. orig. descr.; I. of Pines, in geog. distr.).—READ, Oölogist, XXVII, 1910, 15 (syn.).—READ, Bird-Lore, XV, 1913, 45 (Santa Barbara).—READ, I. of Pines News, VI, Dec. 6, 1913 (descr.; habits).

"Isle of Pines Tanager" READ, Oölogist, XXVIII, 1911, 5 (Santa Barbara Mountain, etc.), 11 (Nuevas River), 114 (West McKinley); XXX, 1913, 125 (Santa Barbara), 131 (I. of Pines).

Ten specimens: Los Indios, Siguanea, Caleta Grande, and Bibijagua.

After having compared the above with a series from eastern Cuba, kindly placed at my disposal by Mr. Charles T. Ramsden, I find myself unable to admit the alleged subspecies *pinus* to recognition. True, the Isle of Pines birds average a little larger, as shown by Mr. Ridgway and by Messrs. Bangs and Zappey, but the difference is certainly slight, the measurements overlapping, and does not in my judgment justify formal separation. Moreover, as regards color, when specimens taken at the same season are compared absolutely no differences between the two series are observable. Messrs. Bangs and Zappey, in their original description, admit that their Cuban specimens (in the case of females at least) were not comparable as to season with those from the Isle of Pines, and it seems as if this circumstance might readily account for the differences to which they call attention. Mr. Ridgway says that he cannot distinguish specimens from the Isle of Pines from those from western Cuba.

The seasonal variations in color in this species are well marked. Males taken in November are more deeply colored than those shot in April and May. A young bird dated September 26 is completing the postjuvenile moult, which apparently involves the rectrices.

The Cuban *Spindalis* is a tolerably common resident species in the Isle of Pines, both throughout the northern part and the portion south of the Cienaga. During the breeding-season it is usually seen in pairs, feeding among the buds and blossoms, particularly of *Jatropha glaucovirens*, in company with the two species of hummingbirds and the Cuban Bullfinch. At other seasons it may be found in small parties in the jungles. According to Messrs. Read and Link it is an unusually silent bird, and likely to be overlooked were it not for the conspicuous colors of the male, but Mr. Zappey says that both sexes sing at times, the song being a low, weak warble. We have so far no information concerning the breeding habits of this species in the Isle of Pines.

137. *Passerina cyanea* (Linnæus). INDIGO BUNTING.

"Indigo Bunting" READ, Forest and Stream, LXXIII, 1909, 452 (I. of Pines April 20).—READ, Oölogist, XXVI, 1909, 75 (I. of Pines); XXVIII, 1911, 7 (I. of Pines, October 20 [18], 113 (West McKinley); XXX, 1913, 131 (I. of Pines). *Cyanospiza cyanea* READ, Oölogist, XXVIII, 1911, 12 (I. of Pines).

A not uncommon species in Cuba in the winter, according to Gundlach, and recorded from the Isle of Pines on a few occasions by Mr. Read, who has noted it as early in the fall as October 18, and as late in the spring as April 20, these dates corresponding fairly well with

what is known of its migration in neighboring regions. Mr. Link saw a single individual at Caleta Grande, on the "south coast," about April 19.

138. *Melopyrrha nigra* (Linnæus). CUBAN BULLFINCH.

*Melopyrrha nigra* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 215 (Punta del Este).  
 "Cuban Bullfinch" READ, Oölogist, XXX, 1913, 130 (I. of Pines, *vide* G. A. Link).

Eight specimens: Caleta Grande and Hato.

All but two of these are adult males, not one of which shows any intermixture of black on the primary-coverts, such as is said to differentiate *M. nigra* on the one hand from *M. taylori* on the other. A series of Cuban specimens, which I have been able to examine in this connection, are absolutely indistinguishable from the Isle of Pines specimens. It is evident, therefore, that Mr. Ridgway's use of this particular character in his diagnosis of the two forms in question (*Birds of North and Middle America*, I, 1901, 562) must have been based on immature birds, for it is certainly quite misleading.

A female in juvenal plumage, dated April 22, is duller than the adult, and the feathers of the back, wings, and posterior under surface are edged and tipped with rufescent brown.

This species was only encountered on the "south coast," where it was not common. Most of the specimens were shot in the low shrubby thickets, feeding among the blossoms of *Jatropha glaucovirens*. It "appears to be restricted in the Isle of Pines to the dry, brushy country south of the Cienaga and even there is not at all common." Mr. Zappey's only specimen was taken at Punta del Este.

139. *Tiaris olivacea olivacea* (Linnæus). YELLOW-FACED GRASSQUIT.

*Tiaris olivacea olivacea* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 214 (Santa Fé and Cayo Bonito; meas.; crit.; habits).—READ, Bird-Lore, XIII, 1911, 44 (McKinley); XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

*Tiaris olivacea* READ, Oölogist, XXVI, 1909, 190 (I. of Pines; descr.; habits); XXVIII, 1911, 12 (I. of Pines).

"Yellow-faced Grassquit" READ, Oölogist, XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 45 (Santa Barbara Mountain, etc.), 6, 11 (Nuevas River), 113 (West McKinley); XXX, 1913, 123 (Pine River), 125, 127 (Santa Barbara), 130 (I. of Pines).

Twenty-six specimens: Bibijagua, Los Indios, Nueva Gerona, and Caleta Grande.

This series shows considerable variation as regards the size of the

black pectoral area in the male, depending possibly upon age, as well as a variation in the exact shade of the upper parts. In the female there is even more variation in the first mentioned respect, some individuals having the black area well marked, while in others there is no trace of it; in the case of the latter, which I take to be younger birds, the yellow of the throat and superciliaries is also duller and more restricted. A female in juvenal dress, taken July 11, is dull grayish olive above, and paler below; the superciliaries and chin-spot indicated in dull buffy; the remiges and rectrices are edged with greenish as in the adult bird, but the color is duller.

The type-locality of this form is Santo Domingo, and according to Mr. Ridgway (*Birds of North and Middle America*, I, 1901, 531) birds from this island differ in certain minor respects from Cuban specimens, and Messrs. Bangs and Zappey confirm this with reference to Isle of Pines examples also. But the differences are very slight, and I agree with these authors in considering them as unworthy of recognition by name.

The Yellow-faced Grassquit is a very common bird, possibly the most abundant bird in the island. It occurs in large scattered flocks during most of the year, frequenting the bushy pastures, citrus-groves, pineapple-fields, etc. In fact it is found almost everywhere, except in the jungles and swamps. In its habits it recalls the Junco of the north, spending most of its time on the ground, and flying up into the trees when disturbed. It feeds on the seeds of various grasses and weeds, and according to Mr. Read occasionally on grasshoppers and crickets. As early as February the flocks break up into pairs, and nesting begins in March. The nests are built low down in a bush or shrub, not necessarily in secluded places, however, as the birds often select the vicinity of houses for this purpose, like the Chipping Sparrow in the north. The nest is a globular affair constructed of dry grasses and other vegetable fibers, with an entrance on one side. Four or five eggs are the usual complement; they are pale blue in color, with small brownish and blackish spots on the larger end.

#### 140. *Tiaris canora* (Gmelin). MELODIOUS GRASSQUIT.

*Passerina collaris* POEY, Mem. Hist. Nat. Cuba, 1854, 426 (Nueva Gerona, *vide* Gundlach).

*Euetheia canora* CORY, Cat. W. Indian Birds, 1892, 113 (I. of Pines, in geog. distr.).

—RIDGWAY, Bull. U. S. Nat. Mus., No. 50, I, 1901, 536 (Cory's record).



*Tiaris canora* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 215 (I. of Pines?, ex Poey and Cory).—READ, Bird-Lore, XV, 1913, 45, and XVI, 1914, 50 (Santa Barbara).

"Melodious Grassquit" READ, Oölogist, XXVII, 1910, 84 (McKinley to Nueva Gerona); XXVIII, 1911, 13, and XXX, 1913, 131 (I. of Pines), 123 (McKinley), 125 (Santa Barbara).

A species peculiar to Cuba, and which has been attributed to the Isle of Pines by Poey, on the authority of Gundlach, who, however, says nothing about such an occurrence himself. This appears to be the sole basis for its inclusion in Mr. Cory's list, to which Mr. Ridgway refers. Messrs. Bangs and Zappey, however, "consider this a very doubtful record, probably due to confusion of names," for the reason that Poey does not include the common Yellow-faced Grassquit in his list, while the present species was not detected either by Mr. Zappey or by Messrs. Palmer and Riley. Mr. Read writes that he has identified this species on a few occasions in the "West Coast" section, and has taken specimens. It was noted in small flocks, and he considers it a rare bird.

141. *Ammodramus savannarum australis* Maynard. GRASSHOPPER SPARROW.

*Colturniculus savannarum passerinus* (not *Fringilla passerina* Bechstein) BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 215 (I. of Pines, March).

*Ammodramus savannarum* (not *Fringilla savannarum* Gmelin) READ, Oölogist, XXVIII, 1911, 13 (I. of Pines).

"Grasshopper Sparrow" READ, Oölogist, XXX, 1913, 131 (I. of Pines, December). *Ammodramus savannarum australis* READ, Bird-Lore, XVI, 1914, 50 (Santa Barbara).

Two specimens: Los Indios.

These were both shot in an open pasture, on October 25 and November 21 respectively, and were the only individuals seen on the entire trip. They are precisely similar to winter specimens from Florida, and evidently represent a normal extension of the winter range of the present form. It is of course possible that there may be a resident form of *Ammodramus savannarum* in the Isle of Pines, as in several of the other West Indian islands.

142. *Passerculus sandwichensis savanna* (Wilson). SAVANNAH SPARROW.

*Passerculus sandwichensis savanna* BANGS & ZAPPEY, Am. Nat., XXXIX, 1905, 215 (I. of Pines, March).

This is only a winter resident, but is apparently not common, Mr. Zappey being the only observer who has been so fortunate as to

meet with it. Specimens were taken by him in March, 1902, but it was not encountered during his second trip. The Isle of Pines seems to be about the southern limit of the winter range of the species.

#### BIBLIOGRAPHY.

The following chronological list of titles embraces all in which there have been found any references, however trivial, to the birds of the Isle of Pines. The list is believed to be practically complete, and includes not only original references, but also papers containing allusions to or quotations from such sources. More than half of the titles are credited to Mr. Arthur C. Read, some of whose articles appeared in a local newspaper, a file of which is unobtainable, and most of the remainder in an amateur ornithological journal, seldom cited by systematic authorities. The writer of course is aware that it is not customary to consider newspaper articles in compiling a scientific bibliography, especially in such a case as this, where they are not available for general reference, and they are given here merely for the sake of completeness, and because some of the matter they contain has been used in preparing the present paper. All titles have been transcribed literally, and the place and date of publication given in full.

1854. POEY, FELIPE. Apuntes sobre la Fauna de la Isla de Pinos.—*Memorias sobre la Historia Natural de la Isla de Cuba*, I, Chapter XXXVIII, June, 1854, 424-431.

Contains a nominal list (pages 426-7) of sixty-three species of birds observed by Gundlach during a six days' stay in the vicinity of Nueva Gerona. As we learn from other sources, this was in January, 1854, and numerous winter resident birds are naturally included in the list.

1856. GUNDLACH, JOHANNES, and CABANIS, JEAN. Dr. J. Gundlach's Beiträge zur Ornithologie Cuba's. [Part IV].—*Journal für Ornithologie*, IV, January, 1856, 1-16.

*Myiadeses elisabeth* (wrongfully) attributed to the Isle of Pines (page 2). (Cf. *Journal für Ornithologie*, XX, 1872, 429).

1861. GUNDLACH, JOHANNES. Zusätze und Berichtigungen zu den "Beiträgen zur Ornithologie Cuba's." [Part I].—*Journal für Ornithologie*, IX, November, 1861, 401-416.

Contains a reference (page 416) to *Chlorænas inornata* as a bird of the Isle of Pines.

1866. GUNDLACH, JUAN. Revista y Catálogo de Aves Cubanas.—*Repertorio Físico-Natural de la Isla de Cuba*, I, [iii], February, 1866, 281-302.

Contains but a single reference to the Isle of Pines—*Chlorænas inornata* (page 298).

1873. GUNDLACH, JUAN. Catalogo de las Aves Cubanas.—*Anales de la Sociedad Española de Historia Natural*, Madrid, II, 1873, 81-191.

Differs but little from his 1866 catalogue. *Chlorænas inornata* from the Isle of Pines, page 143.

1875. GUNDLACH, ["JEAN"] JOHANNES. Neue Beiträge zur Ornithologie Cubas. [Part VI].—*Journal für Ornithologie*, XXIII, July, 1875, 293-340.

*Grus "canadensis"* (= *nesiotes*) attributed to the Isle of Pines (page 293).

1876. GUNDLACH, JUAN. Contribución á la Ornitología Cubana. Havana, 1876, pp. 364.

This was published in a series of supplements (probably separately paged) to the *Anales de la Academia de Ciencias médicas, físicas y naturales de la Habana*, beginning in 1873 (1871 according to Mr. Charles T. Ramsden), and continuing for about three years. Unfortunately no unbound set of this publication is available at present, so that the exact dates of publication of the various parts are not now ascertainable. The above is the title of the completed volume, issued in 1876. There are Isle of Pines references for *Dendroica virens* (page 64), *Chrysotis leucocephalus* (page 124), *Conurus enops* (page 126), *Chlorænas inornata* (page 128), and *Grus "canadensis"* (page 143).

1891. GUNDLACH, JOHN. Notes on Some Species of Birds of the Island of Cuba.—*Auk*, VIII, April, 1891, 187-191.

Contains a note on an abnormally colored example of *Chrysotis leucocephalus* from the Isle of Pines.

1892. CORY, CHARLES B. Catalogue of West Indian Birds. Boston, 1892, pp. 163, 1 map.

In the systematic portion of this work (pages 81-122) are listed all the then known forms of West Indian birds, with an indication of the various islands included in the range of each. The Isle of Pines records herein cited are doubtless (in part at least) from a manuscript list of birds observed on the island during the month of April, 1892, by Dr. Gundlach, and by him placed at the author's disposal (*cf.* statement on page 35).

1895. GUNDLACH, JUAN. Ornitología Cubana, ó Catálogo descriptivo de todas las especies de Aves tanto indígenas como de paso anual ó accidental observadas en 53 años. Havana, 1895, pp. 328, 14 pls.

"The last work of this distinguished Cuban ornithologist, containing many references to the birds of the Isle of Pines." With but few exceptions, however, these references are mere indications of the occurrence there of certain species. The work was published in parts or signatures of sixteen pages each, as monthly supplements to the *Archivos de la Policlínica*, commencing some time in 1893, and concluding in 1895. The title quoted is that of the completed volume.

1901. RIDGWAY, ROBERT. The Birds of North and Middle America. Part I.—*Bulletin United States National Museum*, No. 50, October 24, 1901, pp. xxxii + 715, 20 pls.

The only reference to the Isle of Pines in this volume is the quotation of Mr. Cory's record under the synonymy of *Euethia canora*, page 537.

1902. RIDGWAY, ROBERT. The Birds of North and Middle America. Part II.—*Bulletin United States National Museum*, No. 50, October 16, 1902, pp. xx + 834, 22 pls.  
Contains sundry references to the Isle of Pines in specifying the ranges of certain species. Measurements of Isle of Pines specimens of *Spindalis preleri* on page 69.
1904. COOKE, WELLS W. Distribution and Migration of North American Warblers.—*Bulletin Biological Survey, United States Department of Agriculture*, No. 18, 1904, pp. 142.  
Quotes Mr. Cory's record for *Dendroica virens* from the Isle of Pines (page 88).
1904. RIDGWAY, ROBERT. The Birds of North and Middle America. Part III.—*Bulletin United States National Museum*, No. 50, December 31, 1904, pp. xx + 801, 19 pls.  
Refers to Isle of Pines specimens of *Petrochelidon fulva fulva* (page 53), and quotes several references from other authors bearing on the birds of the island.
1905. BANGS, OUTRAM, and ZAPPEY, WALTER R. Birds of the Isle of Pines.—*American Naturalist*, XXXIX, April, 1905, 179-215. Review, *Ibis*, 1905, 630; *Auk*, XXII, 1905, 329.  
The first authoritative and important annotated list of the birds of the island, based on a collection made by the junior author in the spring and early summer of 1904, together with some data secured on an earlier trip, in March, 1902. With this original information are incorporated the previously published records of Messrs. Cory, Gundlach, and Poey, bringing the whole number of species in the Isle of Pines list up to one hundred and twenty. Six of these are here described as new, and critical notes on others are added. Much interesting and valuable information on the habits, local distribution, etc., of the various species is included. There is an introduction treating of the physical features, climate, etc., of the island, a map, and a number of half-tones illustrating characteristic scenery.
1905. NELSON, EDWARD W. Notes on the Names of certain North American Birds.—*Proceedings Biological Society of Washington*, XVIII, April 18, 1905, 121-126.  
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1905. BANGS, OUTRAM. The Cuban Crab Hawk, *Urubitinga gundlachi* (Cabanis).—*Auk*, XXII, July, 1905, 307-309.  
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1905. CLARK, AUSTIN H. The Genus *Conurus* in the West Indies.—*Auk*, XXII, July, 1905, 310-312.  
Refers to *Conurus cuops* as formerly an inhabitant of the Isle of Pines.
1905. THAYER, JOHN E., and BANGS, OUTRAM. The Mammals and Birds of the Pearl Islands, Bay of Panama.—*Bulletin Museum of Comparative Zoölogy*, XLVI, September, 1905, 137-160.

Measurements given of Isle of Pines specimens of *Butorides virescens maculata* (pages 142-143).

1905. CLARK, AUSTIN H. The West Indian Parrots.—*Auk*, XXII, October, 1905, 337-344.

The Isle of Pines included in the range of the genus *Ara*.

1905. CLARK, AUSTIN H. The Greater Antillean Macaws.—*Auk*, XXII, October, 1905, 345-348.

*Ara tricolor* is set down as recently extinct in Cuba and the Isle of Pines.

1906. HELLMAYR, CARL E. On the Birds of the Island of Trinidad.—*Novitates Zoologicae*, XIII, February, 1906, 1-60.

Measurements given of Isle of Pines specimens of *Hydranassa tricolor ruficollis* (page 50).

1906. COOKE, WELLS W. Distribution and Migration of North American Ducks, Geese, and Swans.—*Bulletin Biological Survey, United States Department of Agriculture*, No. 26, 1906, pp. 90.

Reference is made to the only Isle of Pines record for *Chen hyperborea nivalis* (page 68).

1907. RIDGWAY, ROBERT. The Birds of North and Middle America. Part IV.—*Bulletin United States National Museum*, No. 50, July 1, 1907, pp. xxii + 973, pls. 34.

Critical notes, measurements, and references to a number of Isle of Pines species of Turdidæ, Mimidæ, and Tyrannidæ are included.

1907. ROTHCHILD, WALTER. Extinct Birds. London, 1907, pp. 244, pls. 42.

Includes a reference to Bangs & Zappey's record of *Ara tricolor* from the Isle of Pines (page 51).

1909. READ, ARTHUR C. From the Isle of Pines.—*Oölogist*, XXVI, April 15, 1909, 57-58.

A nominal list (common names only) of forty-four species observed during the course of a two months' stay on the island. Several of these were admittedly imperfectly identified, while others are obviously so.

1909. READ, ARTHUR C. From the Isle of Pines.—*Oölogist*, XXVI, May 15, 1909, 75.

An addendum of twelve species to his previous list, including among others the Cerulean Warbler and Red-eyed Vireo (!).

1909. READ, ARTHUR C. From the Isle of Pines.—*Oölogist*, XXVI, July 15, 1909, 101-102.

Notes on the habits of the "Florida" (= Isle of Pines) Grackle and Ani; list of additional species observed (including such questionable records as Yellow-bellied Flycatcher, Yellow-throated Vireo, and Black-billed Cuckoo); and corrections of identifications in his previous lists.

1909. READ, ARTHUR C. From the Isle of Pines.—*Oölogist*, XXVI, Aug. 15, 1909, 124-125.

Notes on the habits of the Red-legged Thrush, and additions to the list of species recorded from the island. The "Chimney Swift" of his previous list is here set down as probably the Black Swift.

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Interesting notes on the habits of the Cuban Oriole, "Zenaida Dove"



- (i. e., the Isle of Pines Plain Pigeon), Limpkin, and Ruddy Quail Dove.
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- As observed in the Isle of Pines.
1909. READ, ARTHUR C. Isle of Pines Trogon.—*Oölogist*, XXVI, December 15, 1909, 223.
- Brief description and notes on its habits, as observed in the Isle of Pines.
1909. READ, ARTHUR C. Additions.—*Oölogist*, XXVI, December 15, 1909, 224.
- A nominal list of nine additional species, of which at least two may be classed as doubtful.
1910. READ, ARTHUR C. A Paddle Down the Nuevas River, November 20, 1909.—*Oölogist*, XXVII, January 15, 1910, 5.
- A nominal list of thirty-two species.
1910. READ, ARTHUR C. From [the] Isle of Pines.—*Oölogist*, XXVII, February 15, 1910, 14-15.
- Migration dates of various species for the fall of 1909.
1910. READ, ARTHUR C. A Correction.—*Oölogist*, XXVII, February 15, 1910, 15.
- Referring to his previous article in this publication for November 15, 1909, and correcting the names of three species therein mentioned.
1910. READ, ARTHUR C. The Cuban Pigmy Owl.—*Oölogist*, XXVII, March 15, 1910, 35.
- A brief description and account of its habits, as observed in the Isle of Pines.
1910. READ, ARTHUR C. A Few Isle of Pines Nesting Records For 1909.—*Oölogist*, XXVII, April 15, 1910, 42.
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*Petrochelidon fulva* attributed to the Isle of Pines (page 292).
1910. COOKE, WELLS W. Distribution and Migration of North American Shorebirds.—*Bulletin Biological Survey, United States Department of Agriculture*, No. 35, October 6, 1910, pp. 100, 4 pls.  
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1910. BANGS, OUTRAM. Two New Woodpeckers from the Isle of Pines, West Indies.—*Proceedings Biological Society of Washington*, XXIII, December 29, 1910, 173-174.  
Descriptions of *Centurus superciliaris murceus* and *Xiphidiopicus percussus insula-pinorum*, from specimens in the collection of the Museum of Comparative Zoölogy, collected by Wälder R. Zappey.
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The records run from April 14 to November 26. The year is not stated, but is probably 1910. Several species are recorded which are not known to occur in the West Indies except as accidental visitants, and such records are naturally open to suspicion.
1911. READ, ARTHUR C. The Flycatchers of the Isle of Pines.—*Oölogist*, XXVIII, January 15, 1911, 7-9.  
Brief notes on the habits and nesting of five species.
1911. READ, ARTHUR C. A Trip Down the Nuevas to the Sea.—*Oölogist*, XXVIII, January 15, 1911, 9-11.  
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1911. READ, ARTHUR C. List of Birds Observed by A. C. Read On The Isle of Pines, Cuba, From December 1908, to December 1909.—*Oölogist*, XXVIII, January 15, 1911, 11-13.

A formal list, with English and scientific names (many misspelled), but without annotations, of one hundred species, with a supplementary list of fourteen species observed during 1910 but not previously noted. Practically all the questionable records in the author's previous articles are here repeated.

1911. READ, ARTHUR C. Bird-Lore's Eleventh [Christmas] Bird Census. McKinley, Isle of Pines.—*Bird-Lore*, XIII, January-February, 1911, 43-44. Twenty-four species recorded.

1911. READ, ARTHUR C. Birds Seen on one Ten Acre Tract in West McKinley, Isle of Pines, Cuba.—*Oölogist*, XXVIII, July 15, 1911, 113-114.

A nominal list of eighty species, with an indication of their relative abundance. Contains numerous doubtful records.

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A nominal list of nine species observed on June 16, (1911?). The "Virginia Rail" is of course some other species.

1911. RIDGWAY, ROBERT. The Birds of North and Middle America. Part V.—*Bulletin United States National Museum*, No. 50, November 29, 1911, pp. xxiii + 859, 33 pls.

Contains measurements of Isle of Pines specimens of *Riccordia riccordii* (page 543), and description and measurements of *Priotelus temnurus vescus*, based on an examination of the type-series.

1911. BURNS, FRANK L. A Monograph of the Broad-winged Hawk (*Buteo platypterus*).—*Wilson Bulletin*, XVIII, September and December, 1911, 139-320.

On page 195 is given a record of a pair of Broad-winged Hawks seen circling about the crown of Los Tres Hermanos Mountains on April 3, 1910, by Mr. Arthur C. Read, and identified with a field-glass.

1912. OBERHOLSER, HARRY C. The Status of *Butorides brunescens* (Lembeye).—*Proceedings Biological Society of Washington*, XXV, April 13, 1912, 53-56.

Description, measurements, and critical notes on two specimens of this species from Nueva Gerona, Isle of Pines.

1912. OBERHOLSER, HARRY C. A Revision of the subspecies of the Green Heron (*Butorides virescens* [Linnaeus]).—*Proceedings United States National Museum*, XLII, August 29, 1912, 529-577.

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Thirty-seven species recorded.

1913. BANGS, OUTRAM. New Birds from Cuba and the Isle of Pines.—*Proceedings New England Zoölogical Club*, IV, March 31, 1913, 89-92. Review, *Auk*, XXX, 1913, 452-453.  
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1913. TODD, W. E. CLYDE. A Revision of the Genus *Chæmepelia*.—*Annals Carnegie Museum*, VIII, May 8, 1913, 507-603.  
 Isle of Pines references to *Chæmepelia passerina aflavida* (page 562), and list of specimens examined (page 599).
1913. COOKE, WELLS W. Distribution and Migration of North American Herons and their Allies.—*Bulletin Biological Survey, United States Department of Agriculture*, No. 45, May 24, 1913, pp. 70.  
 Contains several references to published records from the Isle of Pines for species belonging to this group of birds.
1913. TODD, W. E. CLYDE. Preliminary Diagnoses of apparently new Birds from Tropical America.—*Proceedings Biological Society of Washington*, XXVI, August 8, 1913, 169-174.  
*Rallus longirostris leucophæus* described from the Isle of Pines, from specimens in the Carnegie Museum.
1913. READ, ARTHUR C. Impressions of the Birds of McKinley, Isle of Pines, Cuba, Made on an Early Spring Morning (March 18, 1911).—*Oölogist*, XXX, August 15, 1913, 122-123.  
 Random notes on various species observed.
1913. READ, ARTHUR C. A Trip to Pine River, Isle of Pines.—*Oölogist*, XXX, August 15, 1913, 123-125.  
 Thirty-three species observed.—July 12-13, 1911.
1913. READ, ARTHUR C. Birds of the West Coast Section of Santa Barbara, During the Month of September.—*Oölogist*, XXX, August 15, 1913, 127-130.  
 Random notes on sundry species, with half-tones of a grove of royal palms, and of the nesting-places of the Cuban Martin and Isle of Pines Parrot.
1913. READ, ARTHUR C. Isle of Pines Note.—*Oölogist*, XXX, August 15, 1913, 130.  
 Records specimens of the Cuban Crow, Cuban Bullfinch, and Roseate Spoonbill lately taken in the Isle of Pines by Mr. Gustav A. Link.
1913. READ, ARTHUR C. Birds Observed on the Isle of Pines, Cuba, 1912.—*Oölogist*, XXX, August 15, 1913, 130-131.  
 A nominal list of species, with an indication of the seasonal status and relative abundance of each, and in some cases the dates of first records. Numerous dubious records are included.
1913. READ, ARTHUR C. Birds Observed on the Isle of Pines From Dec. 1908, to Jan. 1912, Which Were Not Seen During 1912 by A. C. Read.—*Oölogist*, XXX, August 15, 1913, 131.  
 A nominal list of thirty-four species, with dates when each was noted. Numerous dubious records are here repeated.

1913. READ, ARTHUR C. The Herons of the Isle of Pines, Cuba.—*Oölogist*, XXX, August 15, 1913, 132.

Brief notes on ten species.

1913. READ, ARTHUR C. Birds Seen on a Long Journey.—*Oölogist*, XXX, October 15, 1913, "264-268" (= 164-168!).

A nominal list of species observed at various points on a trip from the Isle of Pines to Winnipeg, Manitoba, and return.

1913. READ, ARTHUR C. Red-legged Thrush, *Mimocichla Rubripes Rubripes*.—*Isle of Pines News*, V, October 18, 1913.

This is the first of a series of articles from Mr. Read's pen, published in a local newspaper at Nueva Gerona, and dealing with the birds of the Isle of Pines in a popular way. There is usually a brief description and general account of the habits, relative abundance, etc., of the several species discussed, as observed in the Isle of Pines. Needless to add, these articles are of much more interest and value than the nominal lists of birds which go to make up so many of Mr. Read's contributions to other journals; the text is remarkably free from typographical errors, and scientific names are given in almost every case.

1913. READ, ARTHUR C. Cuban Kingbird, *Tolmarchus Caudifasciatus*.—*Isle of Pines News*, V, Oct. 25, 1913.

1913. READ, ARTHUR C. The Cuban Tody, *Todus Multicolor*.—*Isle of Pines News*, V, November 1, 1913.

1913. READ, ARTHUR C. The Isle of Pines Trogon, *Priotelus Temnurus Vescus*.—*Isle of Pines News*, V, November 8, 1913.

1913. READ, ARTHUR C. The Cuban Grackle.—*Isle of Pines News*, V, November 15, 1913.

1913. READ, ARTHUR C. Isle of Pines Lizard Cuckoo, *Saurothera Merlini Decolor*, Spanish (Arriero).—*Isle of Pines News*, VI, Nov. 22, 1913.

1913. READ, ARTHUR C. Cuban Red-bellied Woodpecker, *Centurus Superciliaris*.—*Isle of Pines News*, VI, November 29, 1913.

1913. READ, ARTHUR C. Isle of Pines Tanager, *Spindalis Pretrei Pinus*.—*Isle of Pines News*, VI, Dec. 6, 1913.

1913. READ, ARTHUR C. The Cuban Oriole.—*Isle of Pines News*, VI, Dec. 13, 1913.

1913. READ, ARTHUR C. Anhigna [sic], *Anhigna Anhigna*.—*Isle of Pines News*, VI, December 20, 1913.

1913. READ, ARTHUR C. The Herons of the Isle of Pines.—*Isle of Pines News*, VI, December 27, 1913.

List of twelve species, with a brief description of each.

1914. READ, ARTHUR C. Antillean Nighthawk, *Chordeiles Virginianus Minor*.—*Isle of Pines News*, VI, January 3, 1914.

1914. READ, ARTHUR C. The Kingbirds.—*Isle of Pines News*, VI, January 10, 1914.

*Tyrannus dominicensis* and *T. cubensis*.

1914. READ, ARTHUR C. Cuban Green Woodpecker—*Xiphidiopicus [percussus]*.—*Isle of Pines News*, VI, January 17, 1914.

1914. READ, ARTHUR C. The Owls of the Isle of Pines.—*Isle of Pines News*, VI, January 24, 1914.

Notes on four species.



1914. READ, ARTHUR C. The Limpkin, *Aramus Giganteus*.—*Isle of Pines News*, VI, January 31, 1914.

1914. READ, ARTHUR C. Bird-Lore's Fourteenth Christmas [Bird] Census, Santa Barbara, Isle of Pines, Cuba.—*Bird-Lore*, XVI, January–February, 1914, 50.

A nominal list of thirty-one species.

1914. READ, ARTHUR C. The Cuban Crane, *Grus Nesiotes*.—*Isle of Pines News*, VI, February 7, 1914.

1914. READ, ARTHUR C. The Warblers.—*Isle of Pines News*, VI, February 14, 1914.

A list of twenty-one species of warblers and three of vireos, including several of doubtful authenticity as regards their occurrence in the Isle of Pines.

1914. READ, ARTHUR C. The Dove and Pigeons of the Isle of Pines.—*Isle of Pines News*, VI, February 21, 1914.

Nine species briefly discussed.

1914. READ, ARTHUR C. The Cuban Martin (*Progne Cryptoleuca*).—*Isle of Pines News*, VI, April 4, 1914.

1914. OBERHOLSER, HARRY C. A Monograph of the Genus *Chordeiles* Swainson, Type of a new Family of Goatsuckers.—*Bulletin United States National Museum*, No. 86, April 6, 1914, pp. viii + 123.

Isle of Pines specimens of *Chordeiles virginianus virginianus* and *C. v. minor* are listed (pages 44 and 84).

1914. RIDGWAY, ROBERT. The Birds of North and Middle America. Part VI.—*Bulletin United States National Museum*, No. 50, April 8, 1914, pp. xx + 882, 36 pls.

Isle of Pines records and references for a number of species of Picidae, Alcedinidae, Todidae, Caprimulgidae, Tytonidae, and Bubonidae. A new owl, *Glaucidium siju vittatum*, is described from the Isle of Pines.

1914. READ, ARTHUR C. The Cuban Cliff Swallow (*Petrochelidon Fulva*).—*Isle of Pines News*, VI, April 11, 1914.

Includes also a note on the occurrence of the Barn and Bank Swallows.

1914. READ, ARTHUR C. The Cuban Quail [,] *Colinus Cubanensis*.—*Isle of Pines News*, VI, April 18, 1914.

1914. READ, ARTHUR C. A Bird Trip to the South Coast.—*Isle of Pines News*, VI, April 25, 1914.

Random notes on a few species observed on an ocean trip from Westport to Caleta Grande, April 19, 1914.

1914. COOKE, WELLS W. Distribution and Migration of North American Rails and their Allies.—*Bulletin of the United States Department of Agriculture*, No. 128, September 25, 1914, pp. 50.

Contains a reference to Gundlach's record of *Grus mexicana* from the Isle of Pines (page 10).

1914. READ, ARTHUR C. Birds of Prey of the Isle.—*Isle of Pines News*, VI, May 30, 1914.

A notice of nine species, the Cuban Sparrow Hawk and Cuban Crab Hawk being treated at some length.

1915. BANGS, OUTRAM. Notes on Dichromatic Herons and Hawks.—*Auk*, XXXII, October, 1915, 481-484.

Contains references to certain species of these groups from the Isle of Pines.

1915. TODD, W. E. CLYDE. Preliminary Diagnoses of seven apparently new Neotropical Birds.—*Proceedings Biological Society of Washington*, XXVIII, November 29, 1915, 169-170.

Contains a brief description of *Columba inornata proxima*, page 170.

CARNEGIE MUSEUM,

December 20, 1915.



FIG. 1. Casas Mountains near Nueva Gerona.



FIG. 2. Jungle on upper slopes of Caballos Mountains.





FIG. 1. Palmetto-pine Scrub, covering large tracts.



FIG. 2. Grove of Royal Palms.



FIG. 3. Bottle-palms. The big tree is frequented by the Isle of Pines Parrot, which nests there.







FIG. 1. Grove of Caribbean Pines near McKinley.



FIG. 2. Mangroves and grass along river-bank.





FIG. 1. Characteristic View in the Cienaga.



FIG. 2. Sea-cliffs at Punta del Este.







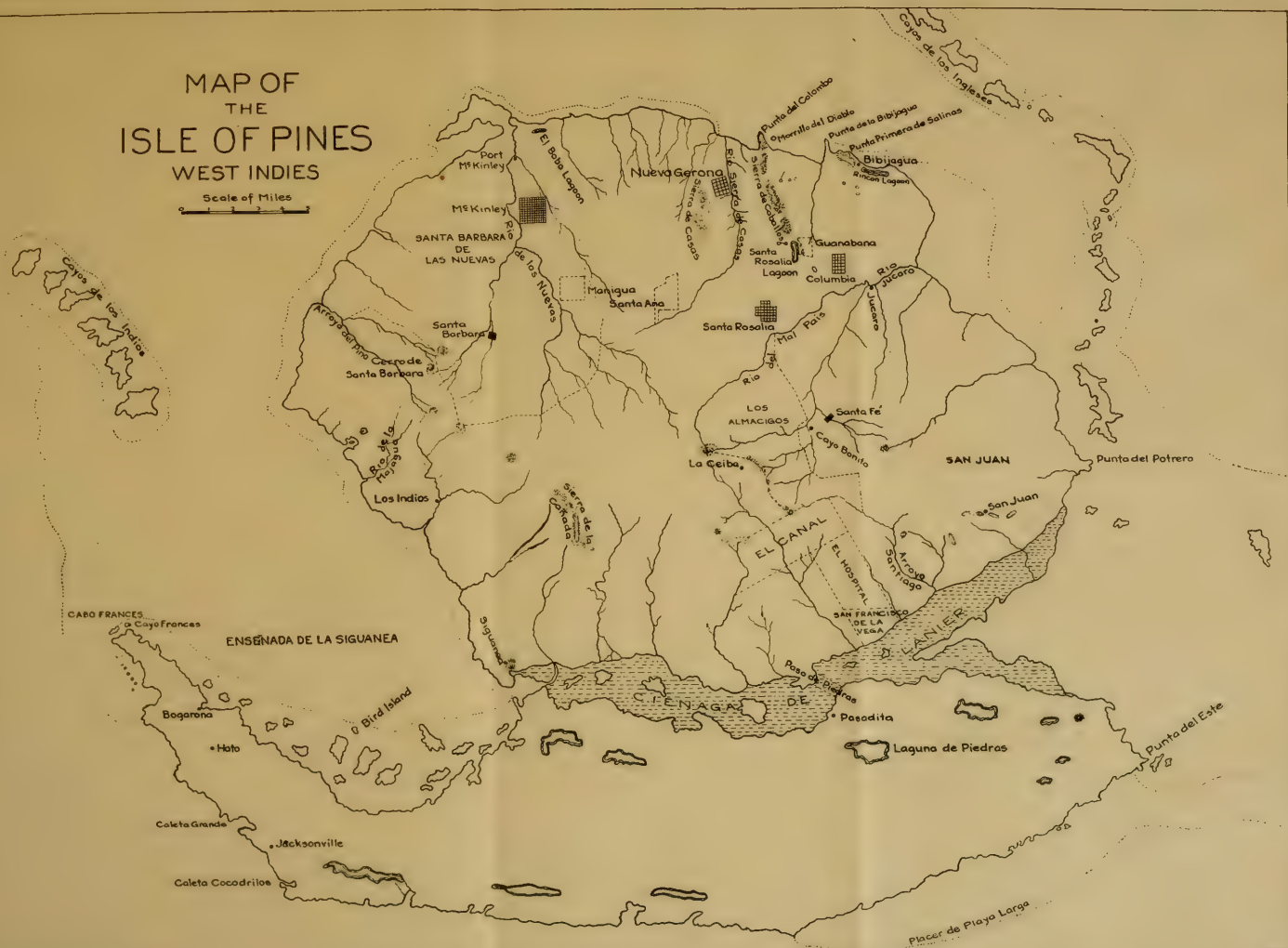
Cuban nighthawk, *Chordeiles virginianus minor* (Cabanis) on nest, Santa Barbara, Isle of Pines.

Photographed by A. C. Read. By the Courtesy of Mr. R. M. Barnes, Editor *The Oölogist*.



# MAP OF THE ISLE OF PINES WEST INDIES

Scale of Miles  
0 1 2 3 4 5





## XII. THE REPTILES AND AMPHIBIANS OF THE ISLE OF PINES.

BY THOMAS BARBOUR.

(PLATE XXVIII.)

### INTRODUCTORY.

This paper is based upon material from three sources: *First*, a very extensive and thorough collection made by Mr. G. A. Link of the Carnegie Museum during a long stay upon the island; unfortunately Mr. Link preserved his material in formalin, so that in many cases the condition of the specimens is far from being of the best. *Second*, an interesting series submitted to me by Dr. Leonhard Stejneger, collected by Messrs. Palmer and Riley at Nueva Gerona; this collection is not extensive, but is in an excellent state of preservation. *Third*, a series collected by Winthrop S. Brooks, Señor V. J. Rodriguez, and myself during a short visit to the Isle of Pines in March, 1915. Upon this occasion the weather was favorable and we obtained a large number of different species of reptiles, our efforts being to procure as many species as possible in a short time, without attempting to secure very many individuals, and especially to get some notes upon the colors in life of certain of the species, notably those of the genus *Anolis*, for in some of these creatures the colors in life have considerable taxonomic importance.

The Isle of Pines lies about sixty miles south of the Province of Havana, Western Cuba, and may be reached by proceeding to Batabanó by rail, and then taking a small steamer, which brings one after a delightful night's sail to either the port of Jucaro or Nueva Gerona, the capital. The island is roughly thirty by forty miles in extent, about the size of the State of Rhode Island, containing some twelve hundred and fifty square miles. It is divided into two parts by a large swamp "La Cienaga." I quote in this connection from Mr. Zappey's field notes, given in "The Birds of the Isle of Pines" by Bangs and Zappey (*American Naturalist*, Vol. XXXIX, 1905, p. 182):

"The land south of the Cienaga is of coral formation with a very shallow soil spread over the coral rock, and with deep holes or pits



everywhere. A number of prints of fossil shells of various kinds are observed in the coral rock. Fires devastate this part of the island, burning up the soil and the very roots of the trees, and leaving nothing behind but the bare coral rock, and the region is very sparsely inhabited. The trees of this region are mostly hard wood, there being no pines and very few royal palms."

The country north of the Cienaga is entirely different. It consists mostly of dry open pine-woods, interspersed with groves of royal palms and with dense jungly vegetation along the water-courses. There are great areas of savanna land, upon which even the palm-trees will not grow. In general, the country is extremely infertile, and may only be compared with similar areas in the Province of Pinar del Rio in Cuba, where like conditions obtain. There are a number of hills; most of which are composed of metamorphosed igneous rock, much weathered and eroded, while near Nueva Gerona there are two parallel chains of limestone hills, one, called the Sierra de Casas, lying to the west of the river on which the town is situated, and the other the Sierra de Caballos, lying to the eastward. The Sierra de Casas does not reach the sea, but the other Sierra, after extending some miles through the savanna country, reappears after a short break and pushes out to the north coast, where it ends in a bold, precipitous headland. This detached extension of the Sierra de Caballos is known locally as "Calumpo," a corruption of *Punta del Colombo*. The limestone in these hills is brilliant glistening white, of a beautiful quality, and much harder and more marble-like than I have seen in any of the limestone outcrops in Cuba from one end of the island to the other. The mountain-sides are clothed with dense, thorny scrub, and with scattered high woods wherever there may be sufficient soil, while the shores of the whole island, of course, are fringed with mangrove swamps, except where there are a few white sandy beaches. Most of our collecting was done from Nueva Gerona in the vicinity of the limestone mountains and in the savannas. Mr. Link worked principally in the region about Los Indios, a locality which allowed him access to the Cienaga and the region where the greatest variety of birds was to be obtained. So much for the topography of the island.

Its climate is excellent during the dry season, but the rains begin in May and last until October, and I am told that the face of the country is entirely changed, and that the moist conditions obtaining make life far less agreeable than during the winter months. Generally

speaking, the island is always healthy. In the past the hot springs at Santa Fé attracted many Cuban visitors, as the island, of course, since its discovery has been a dependency of the government of Havana. After the Spanish-American war, a few Americans found their way there, and persuaded themselves that the island was to be retained by the United States. This rumor spread, and speculators in land soon arrived. "Land-booms" followed, and farms and citrus-fruit plantations were sold in many localities. The result is that at present there is a large body of American residents, most of whom came to the island entirely untrained in tropical agriculture, and who purchased farms unsuited for the purpose for which they were sold. This has naturally resulted in disappointment and hardship. The local Cuban authorities proved to be most courteous, and helped us on the occasion of my visit in every possible way. The natives reside principally in Nueva Gerona and its environs, although there are scattered peasants living throughout the island, who will always be found to offer the wayfaring naturalist a charming and courteous, if humble, hospitality.

#### LIST OF THE SPECIES.

##### 1. *Crocodilus americanus* (Laurenti).

The *Caiman*, as it is called by the Spanish-speaking inhabitants of both Cuba and the Isle of Pines, is common in all the salt water estuaries and chief river-mouths of the island. This species does not often push its way up into fresh water, but prefers the lagoons and ponds among the mangroves, where the water is salt or strongly brackish. A specimen about four feet long obtained by Mr. Zappey, shows, as one would expect, that this species is identical with the typical form of this widely ranging creature, which occurs from Florida, through the Greater Antilles, along the coasts of Mexico and Central America, and, reappearing on the Pacific Coast, extends from Southern Mexico to Ecuador. Its habits are astonishingly similar throughout its whole range, and the species is like the old world *Crocodilus porosus* in its liking for salt water.

##### 2. *Crocodilus rhombifer* Cuvier.

I have not seen a specimen of this species from the Isle of Pines. The Cubans, however, are well aware of its existence and call it invariably *Cocodrilo*, in contradistinction to the *Caiman*. I have long

been familiar with the habits of this species in the great Cienaga de Zapata in Cuba. Here it is extremely abundant and entirely confined to the fresh-water swamps. Gundlach, on his visit to the Isle of Pines, reported that it was abundant there in the Cienaga. It has apparently remained so until the present time.

3. ***Pseudemys palustris*** (Gmelin).

The *Jicotea*, as the Spanish-speaking creoles call this turtle, is abundant on the Isle of Pines, but less so than in Cuba, except perhaps in the ponds of the Cienaga, where it is said to be very common. In Cuba, especially at Manzanillo, it is esteemed a great delicacy, but I did not observe that they were regularly hunted in the Isle of Pines as they are in Cuba, where the waters of the Rio Cauto supply many to the markets of the neighboring cities and towns. Mr. Link's series was obtained at Los Indios, while Brooks, Rodriguez, and myself procured others in the streams about the Sierra de Casas.

4. ***Sphærodactylus notatus*** Baird.

Brooks, Rodriguez, and myself were the only ones fortunate enough to have found this species in the Isle of Pines. We secured four specimens in the Sierra de Casas, while grubbing about among dead leaves and scratching up the ground under the heaps of rock at the foot of the cliffs of the Sierra de Casas. We were finding living specimens of the genus of land shells, *Megalomastoma*, and found these four little lizards in the same places as the shells. I have compared these with examples from the Bahamas, Key West, and many localities in Cuba; all are the same. Another Cuban species of the genus *Sphærodactylus*, viz. *S. nigropunctatus*, is so far unreported from the Isle of Pines, which is perhaps not strange, as in Cuba this form is principally, if not wholly, confined to the Eastern province, Oriente.

5. ***Sphærodactylus elegans*** Reinhardt & Lütken.

While I think it is generally true that individuals from the Isle of Pines representing this species are inclined to be a little less brilliant in color and to have rather narrower dark cross-bands than those from Cuba, I find too great a variability among the latter to make it at all probable that we are dealing with anything more than a slightly different average condition of individual variation. Mr. Link secured a series at Los Indios, while we found a few at Nueva Gerona. It

probably occurs all over the island, as it does in Cuba. One usually finds this tiny creature, perhaps the smallest of living reptiles, in old houses, behind furniture, on the wall behind pictures, and in similar situations. The islanders called it simply *Salamanquita*, using the same name for the other species of the genus. The Cuban peasants for some reason, which I have never learned or guessed, call it *Salamanquita de la Virgen*.

#### 6. *Sphærodactylus cinereus* Cocteau.

Link's series, and our own as well, shows that the representatives of *S. cinereus* from the Isle of Pines are absolutely the same as examples from Cuba. This is another species, which I think is encountered in houses, decidedly more often than in the forest under bark or stones. The reverse is the case with *S. notatus*, which has not taken so kindly to human companionship. It is called *Salamanquita* and often *Salamanquesa*, although the latter name is in Cuba more correctly applied to *Tarentola*, a genus which is as yet unknown in the Isle of Pines.

#### 7. *Anolis equestris* Merrem.

A careful comparison of a small series of the Giant Anolis secured by Link and specimens in the Museum of Comparative Zoölogy from different parts of Cuba has failed to reveal any character by which they may be separated. We did not secure an example of this species in the Isle of Pines, but we saw two, one in the Sierra de Casas, and one in the dense woods east of Colombo promontory. They were in dense foliage in tall trees and could not be reached by our small collecting guns, unfortunately the only arms we happened to have with us at the time. I imagine from what the Cuban school-master at Nueva Gerona and other well-informed persons told me, that this lizard is even less common in the Isle of Pines than in Cuba. In Cuba it is far from abundant, but may be found by careful searching in most of the extensive plantings of mango and other fruit-trees, which, of course, are not to be found in the vastly less fertile Isle of Pines.

#### 8. *Anolis sagrei* Dumeril & Bibron.

This, the commonest species of the genus, is abundant throughout the island. My field-notes state that the skin of the dewlap is dull brick-red, the scales standing out as blackish, while the anterior edge

is lemon-yellow. On the whole, while I find many individuals which are not really typical, I cannot make up my mind to separate an Isle of Pines race.

9. *Anolis porcatus* Gray.

I have examined series of the common green *Anolis* in all the collections from the Isle of Pines and compared them carefully with Cuban examples, but I cannot find cause for separating them. In both of the localities the species is one of the commonest of reptiles about plantings in towns and cultivated gardens. In the woods and in uncultivated country the species is generally rare.

10. *Anolis homolechis* Cope.

This woodland *Anolis*, which is always so conspicuous in Cuba because of its brilliant ivory-white dewlap, is also found in the Isle of Pines, where it is by no means uncommon, especially in the narrow jungly zones along the many water-courses, which meander through the pine-barrens of the island. Although Cuban specimens have a tendency to have fewer, hence larger, scales between the frontal rugæ, this character is not sufficiently stable to separate the two groups of individuals into races.

11. *Anolis angusticeps* Hallowell.

With this little-known species I am able to identify a series of lizards in each of the three collections from the Isle of Pines. These specimens are the same as others from Guane, Province of Pinar del Rio, Cuba. In life the specimens which I myself took had a dewlap tinted with peach-blow pink. They varied from ashy gray to light gray greenish in coloration. All were found on the trunks of royal palm-trees, which grow along the road-sides near Nueva Gerona. The species is much more abundant in the Isle of Pines than in Cuba.

12. *Anolis alutaceus* Cope.

I have seen but two specimens of this species from the Isle of Pines. They are U. S. Nat. Mus. Nos. 27916-17, Nueva Gerona, Palmer and Riley, collectors. These individuals I have compared with one of the types of Cope's *A. alutaceus* (Mus. Comp. Zoöl. No. 10932) and with a large series of fresh Cuban examples from various points. At first I thought that the Isle of Pines lizards had more pronounced vermiculate rugosities on the head-shields, until I found a few from



the Sierra Maestra equally rugose. There seem to be more canthal scales in the lizards from the Isle of Pines, but this character is not a fixed one in Cuban specimens. I do not really feel able specifically to separate the two groups of individuals, in spite of a distinct feeling that in general these creatures impress one in a perfectly inexpressible way as being different.

### 13. *Norops ophiolepis* (Cope).

The grass-lizard of the Isle of Pines seems to be absolutely the same as the one found in Cuba, as far as scutation goes. In color it seems to be rather more brilliant, the mid-dorsal stripe extending a little further forward on the region of the nape. In general the size is distinctly larger. Mr. Link obtained a large series of this lizard at Los Indios, while Brooks, Rodriguez, and I found it abundant and obtained a number of specimens in the open-plains country near Nueva Gerona, where there was abundant bunch-grass. It is a lizard which lives entirely in the grass, never being found in even the lowest bushes.

### 14. *Cyclura macleani* Gray.

The iguana is common upon the Isle of Pines, and is usually to be found in the scrub on the flanks of the Sierras and in the savannas about the coasts. Here the tracks may often be seen in the sand. We did not see tracks nor specimens, nor did we hear of its occurring in the pine-barrens. As Mr. Link's collection contained a fine series of these bulky creatures, and as our stock of alcohol and containers was somewhat limited, we preserved no iguanas. A study of Link's series enables me to state, that, although there are a few characters which usually appear to be slightly different from those in the Cuban representatives, the individual variation is nevertheless too great to make it wise to recognize two races.

### 15. *Leiocephalus carinatus* Gray.

This lizard, which has been aptly termed the "lion-lizard" by some of the English-speaking colonists in the Bahamas, and which is usually called by the Spaniards *Raborocado* or *Perico*, is found abundantly about the cliffs near the sea-shore in the Isle of Pines, as in Cuba. I do not believe that individuals from the two localities are specifically separable.

16. **Leiocephalus cubensis** Gray.

Dr. Stejneger has kindly informed me that he believes that this name proposed by Gray (Ann. Mag. Nat. Hist., Vol. V, 1840, p. 110) should supersede *L. vittatus* Hallowell, which is the name in current use and the one used by Boulenger in the "Catalogue of Lizards in the British Museum" (Part II, 1885, p. 163). Hallowell's name did not appear until 1856. We frequently met with this lizard in the open savannas in various parts of the island and procured a series of specimens, as did also Mr. Link. They seemed to average decidedly smaller in size than the Cuban specimens, and seemed in general to be of a sandier, more bleached-out color, often lacking the rich maroon on the sides of the head and body, which is usually conspicuous in the Cuban specimens. Still I can find no characters of squamation which seem to be sufficiently fixed to justify me in describing the race from the Isle of Pines as distinct.

17. **Ameiva auberi** Cocteau.

The ground-lizard of the Isle of Pines seems to be absolutely identical with that of Cuba. It is fairly abundant and is represented by specimens in Link's collection from Los Indios and in our own from Nueva Gerona and various other localities near by. It is found in open, arid savannas, in the pine-woods, in the plant-association of the beach-grape near the shores, and more sparingly in the scrub, which clothes the precipitous slopes of the two parallel limestone mountain-ranges. In common with so many other species of this family the food of *Ameiva auberi* consists largely of ants, and it is no uncommon sight to see them digging into the craters of ant-nests or crawling noisily about among the dried giant beach-grape leaves, which always seem to be swarming with ants.

18. **Epicrates angulifer** (Bibron).

The big boa, for some reason or other always known to the natives as *Maja de Santa Maria*, is even more abundant on the Isle of Pines than in Cuba, though its habits seem to be entirely the same in both places and it apparently occurs in the same sort of country. I have been unable to observe that there is any difference between individuals from the two localities.

19. **Tropidophis pardalis** (Gundlach).

Mr. Link secured a series of this species at Los Indios. There is apparently no difference between these specimens and a large series

from various parts of Cuba and the Bahama Islands. The species is largely nocturnal, like so many Boiids, and is singularly harmless and inoffensive. There is no distinctive Spanish name for these snakes; we have usually applied to them the names "*majasitas*," "*jubitos*" or similar diminutives. In the Bahamas the "conchs" call them "Thunder-snakes," since they appear so frequently after rain-storms, drowned out from their subterranean hiding-places.

20. *Alsophis angulifer* (Bibron).

Unfortunately our party did not meet with this species upon the island. Mr. Link secured a series, but they have become so darkened through faulty preservation that it is impossible to say whether a separation should be made on the same sort of characters as those which serve to distinguish so sharply the insular *Leimadophis* from the Cuban.

21. *Leimadophis nebulatus* sp. nov. (Pl. XXVIII, figs. 1-2.)

Type an adult male, Mus. Comp. Zoöl., No. 11092, from the Sierra de Caballos, Isle of Pines, W. I., collected March, 1915, by Barbour, Brooks, and Rodriguez. Paratypes in Carnegie Museum, Nos. 302 to 308 and 1535; G. A. Link, collector.

This form does not differ from *L. andreae* of Cuba in squamation, but it does differ regularly and definitely in color-pattern. I have sufficient material to show that this character is really diagnostic, as is not always the case in reptiles.

In the type the lateral boundary between the dark, almost black dorsal and the ivory-white ventral areas is not clearly defined, and there are irregular dark-centered rhombs of white extending up on the sides of the anterior part of the body, sometimes almost meeting at the mid-dorsal line. Along the sides are many irregular scattered white spots. The figures (*cf.* Plate XXVIII, figs. 1 and 2), show the details. In Cuban specimens there are no such extensive white markings, but only occasional scattered white dots or vertical or horizontal series of small dots, more often no white at all in the dark dorsal and lateral zones.

The specimens collected by Link at Los Indios show the same markings as the type, less strikingly, however, since they have been darkened in color by being preserved in too strong formalin.

As for variation in the Cuban species, I may say that the pattern is

equally fixed. (See Pl. XXVIII, figs. 3 and 4) Among twenty specimens only one shows any tendency toward the condition in *nebulatus*, and this is an old specimen, which came many years ago from Prof. Felipe Poey, and which served as one of the types of *Dromicus cubensis* Garman. It is not impossible that some correspondent of Poey, or perhaps even Gundlach himself, got the specimen in the Isle of Pines, and that it got mixed with Cuban material and sent here.

Seven Isle of Pines specimens average 143 for ventral scale-counts, while the same number of Cuban examples average 144. There is no greater difference in the average number of subcaudals, while the number of scale-rows is seventeen in all.

The specimen, which I have made the type, was found in dry scrub-country near the Sierra de Caballos. We recognized at first sight that it was far whiter in appearance than Cuban specimens. In Cuba *L. andreae* is a common snake, found in cultivated lands in wooded regions, under stones, burrowing in the ground. It is not as fond of wet swampy country as is *Alsophis angulifer*. The habits of *L. nebulatus* are probably just the same.

## 22. *Tretanorhinus insulæ-pinorum* sp. nov.

Type, an adult, Carnegie Museum No. 311, from Los Indios, Isle of Pines, W. I., collected by G. A. Link. Paratype, Mus. Comp. Zool., No. 11,190.

This species differs from the Cuban *T. variabilis* in having regularly twenty-one, instead of nineteen rows, of scales around the body. I have examined three examples taken by Link at Los Indios and found this condition common to all. The series of Cuban examples in the Museum of Comparative Zoölogy, consisting of one from the Rio Tana, near Manzanillo, one from San Diego de los Baños, four from Soledad, near Cienfuegos, and three from the Rio Cuyaguatete near Guane, all taken by the writer during various Cuban excursions, have nineteen rows of scales. There do not seem to be other differences in squamation and the color is the same, so far as one may judge from Mr. Link's material preserved in formalin.

This nocturnal water-snake is called *Catíbo* in the Isle of Pines by the natives. This is the same name which is used in Western Cuba. The catíbo leads a colorless existence, spending its daylight hours hidden beneath stones, roots, or drift-rubbish in some creek or brook. By night it fares forth a-hunting and if one follows along the water

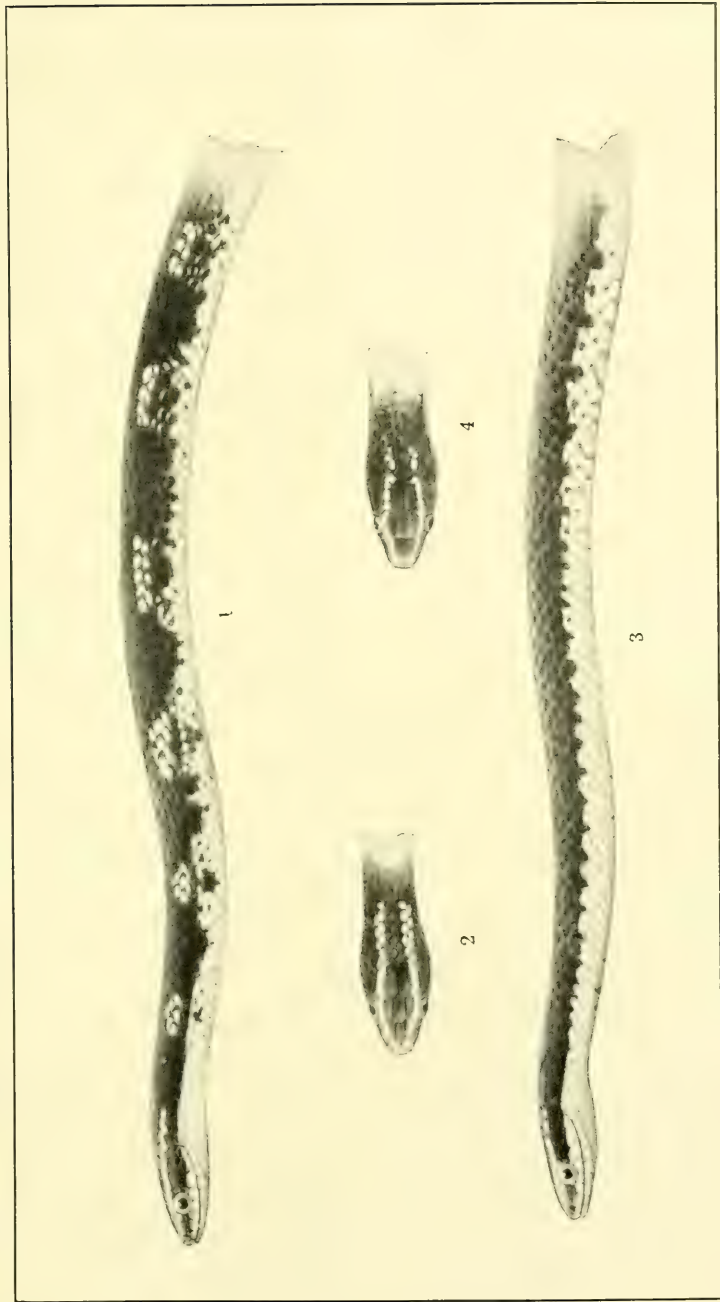


FIG. 1. Lateral view of anterior portion of type of *Leimadophis nebulatus*, sp. nov., Mus. Comp. Zool., No. 11,092.

FIG. 2. Top of head of No. 11,092, Mus. Comp. Zool.

FIG. 3. Lateral view of anterior portion of a specimen of *L. andreae*, Mus. Comp. Zool., No. 10,856, from S. Antonio de los Baños, Cuba.

FIG. 4. Top of head of No. 10,856, Mus. Comp. Zool.





courses after dark with a good light the catibos may be seen swimming slowly about beneath the surface. I have never seen one emerge even part of its length from the water, and they rise to breathe but rarely. The members of this genus are the most strictly aquatic reptiles I know, quite equalling the Hydrophids in this respect. I have never heard of their eggs being found, and I have often wished I knew whether they come ashore to lay. I presume that they do.

23. *Hyla septentrionalis* Boulenger.

This very common tree-frog, so widespread in Cuba and the Bahamas, occurs also in the Isle of Pines. Link preserved a large series. The species has been renamed several times, the types of the synonyms representing different variations in the form of the casque. This is the frog used in Cuban biological laboratories for dissection or experimental purposes in place of the genus *Rana*, used in the United States and in Europe. The creature is most commonly caught in banana-groves and is often called "*La Rana de los Platanales*," or "*La Rana Platanera*." Their voices may be heard on any rainy night and often on a showery afternoon as well, sounding like a rope being pulled in jerks through a block which is badly in need of oiling.

24. *Bufo peltacephalus* Tschudi.

The giant toad, *sapo*, as it is universally called, is found in many different situations. Not far from Nueva Gerona we found a number under the fallen trunks of some royal palms which had been wastefully cut down to use their leaves for thatching. One trunk sheltered seven enormous fellows, which were apparently living in peace and harmony with a numerous company of brightly colored harvest-men (*Phalangida*). These toads are rarely met with abroad even at night and by daylight are always found hidden in the mouths of drains, under logs or stones, or in similar situations. It is by far the most abundant and widely distributed member of the genus in the Cuban region. There is no difference between specimens in the fine series before me procured by Mr. Link and the host of Cuban specimens in the Museum of Comparative Zoölogy.

25. *Bufo empusus* Cope.

Link's series from the Isle of Pines has been compared with specimens from Herradura, Pinar del Rio, Cuba. They are the same. I

was told by the country-folk on the Island that the *Guasábalo* burrows in the earth, making little caves for itself, and living in colonies just as they do in Cuba. For details regarding its habits consult Gundlach (*Erpetologia Cubana*, Havana, 1880, p. 87) and Barbour (*Mem. Mus. Comp. Zoöl.*, Vol. XLIV, 1914, p. 243). This toad is the real *Guasábalo*, although other amphibians are sometimes called by that name. It is also called *sapo de concha*, referring to the curious ossified casque of the head, which is so hard as to be quite shell-like.

26. ***Eleutherodactylus ricordii*** (Dumeril & Bibron).

So far the only species of this genus-known from the Isle of Pines is *E. ricordii*, which is also very widely distributed in Cuba.  $\mu$

# ANNALS

OF THE

# CARNEGIE MUSEUM

VOL. X, NOS. 3 AND 4.

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## EDITORIAL NOTES.

AT the time when the work of exploring the fossil beds in Uinta County, Utah, was undertaken by this Museum, much of the territory was still comprised within the Ute and Uncompahgre reservations. Some of these lands since we first entered the region have been thrown open to occupation and settlement by the whites. In the territory thus thrown open was the land on which our quarry, north of the town of Jensen, is located. Being concerned for the continuance of the work of the Museum, and apprehensive that some wandering prospector for the purpose of levying tribute upon the Museum, might enter a claim to the tract upon which we were working, the Director instructed Mr. Earl Douglass to take steps to file a claim to eighty acres covering the site of the quarry, under the mineral laws of the United States, we having been advised by eminent legal authorities that such a procedure was proper. After all the necessary steps had been taken we were to our astonishment informed by the authorities in Washington that fossilized bones are not "mineral." Though refusing to give us title to the land under the mineral laws, the Secretary of the Interior, realizing the importance of the aims of the Museum and the desirability of allowing scientific investigations at that point to be continued, recommended to the President that the eighty acres should be set apart and withdrawn from entry under the act of June 8, 1906 (34 Stat., 225). By proclamation of the President under date of October 4, 1915, the recommendation of

the Secretary of the Interior was carried into effect, the tract being designated as the "National Dinosaur Monument." Subsequently the application of the Carnegie Museum for permission to continue the work which it had commenced was granted, subject to the rules and regulations in such cases made and provided by the Department of the Interior, and Mr. Douglass has been instructed to prosecute the work with all due diligence and energy.

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It is with great satisfaction that we view the completion of the installation of the skeleton of *Apatosaurus louisæ*. The specimen has been mounted alongside the skeleton of *Diplodocus carnegiei*, and room has been reserved in the gallery to permit the erection between the two colossal specimens of an example of *Allosaurus*, or one of the other carnivorous dinosaurs of Jurassic times, which preyed upon the Sauropoda. We have not as yet placed in position the skull which was found with the skeleton of *Apatosaurus*, having resolved to await the further progress of research in the quarry, which may possibly result in the discovery of a skull directly articulated with the cervical vertebræ, thus settling beyond the shadow of a doubt what type of skull belonged to the animal.

The skeleton of *A. louisæ* is the largest skeleton of a dinosaur at the present time erected in any museum, and is probably the most perfect specimen of a sauropod dinosaur which has thus far been found. It consists throughout of the bones of one individual, the entire vertebral series of bones from the atlas to the end of the tail having been found in such order as to enable their collocation without any doubt as to the correctness of the positions assigned to them.

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A PARTITION-WALL has been erected at the western end of the Gallery of Useful and Industrial Arts for the purpose of setting off a space in which it is intended to bring together the beautiful and valuable collections, which have been entrusted to the custody of the Museum by Mr. H. J. Heinz. Cabinets of appropriate form, constructed so as to secure the best artificial illumination, are being designed in order that a better display of the wonderful ivory-carvings and other artistic objects in these collections may be made.

One of the notable recent gifts of Mr. Heinz is a large lacquered



Buddha from Japan, over eight feet in height including the pedestal. It dates from the Ashikaga period (1338-1573).

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There has been received from Paris a collection of forty small figures representing the costumes of the nobility and peasantry of France at the middle and toward the end of the eighteenth century. They are exquisitely attired, and, when mounted and displayed in the cases which are being constructed for them, will form a most attractive exhibit.

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MR. HERBERT DUPUY with great kindness has consented to place upon view his collection of old silverware, which has for some time been exhibited in the Metropolitan Museum in New York. It contains a number of pieces, which have long been in the possession of his family, as well as some which have great interest because they represent the art of the silversmith as practiced in America at an early date. In addition to the specimens loaned by Mr. DuPuy there are a number of pieces which have been deposited in the Museum by Mrs. Frank Osborn, including a spoon made in 1837 in Pittsburgh by McFadden. The Director has made a loan, which is exhibited in the same case, of a silver tea-pot, dating from the seventeenth century, having upon it the coat-of-arms of the Benezet family. This piece has come down to its owner as an heirloom through six generations, it having been brought to America by Jean Etienne Benezet, when he resolved to exchange Philadelphia for London as a place of residence in 1720, he having after the Revocation of the Edict of Nantes made his home in London for a number of years. Among his descendants have been a number of men and women distinguished in American life.

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THE Museum has acquired by purchase a selection of the enlargements of the photographs made by the photographer who accompanied Sir Douglas Mawson on his expedition to Antarctica. Those photographs which illustrate the animal life of the region were of especial interest, and it was these which were selected. As soon as they can be framed and properly displayed, some of them in the Gallery of Birds, others in the Gallery of Mammals, they will be placed upon view.

IN February we had the pleasure of welcoming to the Museum for a brief visit Mr. B. Preston Clark, of Boston, who, in the midst of a very active business career, is devoting as much of his leisure as he can command to the collection and study of the hawk-moths (Sphingidæ) of the world. We are greatly indebted to him for the addition to our collection of a number of species which have not hitherto been represented with us. The collection of Mr. Clark has grown to be the largest in the number of species which it contains in America. It was gratifying to learn from him that with the exception of his own collection he regards that in the Carnegie Museum as being the largest in any museum in the new world. It contains approximately one half of all the known species and subspecies which up to the present time have been described, and Mr. Clark, with great generosity, has signified his intention in the not distant future of filling up a number of the gaps which exist in it.

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VERY large collections of the birds and insects of Bolivia have been recently received from our collector, Mr. José Steinbach. The Director is informed by Mr. Todd that these collections add some seventy-five species of birds hitherto not represented in our collection. What proportion of the new material contained in the entomological collections will prove to be new to us, or in fact new to science, it has not yet been possible to decide. The collections are being classified and arranged in a preliminary way with a view to study.

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MR. GARRETT C. PIER, formerly connected with the Metropolitan Museum in New York, spent some time in January last at the Museum in labeling the collection of ivories donated or deposited in the Museum by Mr. H. J. Heinz. He also labeled the Chinese collections deposited in the Museum by Miss Jean Adams.

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A GREAT deal of pleasure has been given, especially to the children frequenting the Museum, by an exquisite model of a Pullman Palace Car, presented by Mr. Herbert DuPuy, the exterior of which has been made at great expense of gold and silver, and the interior of which carries out the pattern of the original in every minute detail. We

have installed miniature electric lights in this model, but owing to the very diminutive size of the lights which it is necessary to employ, we discover that they require very frequently to be replaced, as they speedily "burn out." We sometimes wish that the cost of radium might soon be so reduced as to make possible the permanent illumination of such objects without the necessity of daily repairs—or that Professor Langley's experiments upon the lantern-flies of the tropics, which, he averred, produce "the cheapest form of light," may be continued by some genius in such a way that the time may come when our present clumsy system of electric illumination may be superseded by something better and more economical. Wonderful as have been the strides made within the last century in providing means of interior illumination, the physicist can see vistas opening in the future which remain to be filled with achievements.

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THE work of an editor is often thankless and involves a great amount of intense and wearisome application to minute details. It nevertheless has its compensations, and recently the receipt of a letter from Hon. Hugh M. Smith, the United States Commissioner of Fisheries, in which he congratulates the editor of the *ANNALS* and *MEMOIRS* of the Carnegie Museum, and goes so far as to say, "It is a pleasure to realize that high-class work of this kind is being done," has served to carry a measure of cheer into "the gloom of the sanctum."

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THE official exhibit of the Persian government, which was on display at the Panama-Pacific Exposition, has just been installed in the Carnegie Museum, and will remain here during the last days of April and the month of May. We owe the loaning of this exhibit to the kindness of the Persian Commissioner General, Mirza Ali Kuli Khan. The exhibit consists of tapestries, brocades, velvets, embroidery, miniatures, illuminated books and manuscripts, potteryware, enamels, lacquer, and jewelry. It contains multitudes of objects dating far back into the past, every one of which has a history and a significance which makes it intensely interesting. One conspicuous piece of tapestry was intended as a covering for the throne, and was so used. It is said to have taken the labors of one hundred women for ten years to produce this wonderful piece of needlework.

A number of the objects shown belonged to the famous Shah Abbas. It is utterly impossible within the limits of a paragraph or two to convey any idea of the interest of this unique and remarkable collection which we regard it as a great favor to be allowed to display within our halls.

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THE Annual Report of the Director of the Museum was issued about the middle of April, and shows that the fiscal year ending March 31 has been characterized by rapid growth in the collections of the Museum as well as by energetic efforts to make these things the means of culture in the community. The Museum has become an institution ancillary to a multitude of institutions throughout the region of which Pittsburgh is the center. The manner in which the students in the universities, colleges, and high schools of the district are employing the resources of the Museum is exceedingly gratifying. They are not mere casual visitants, but they are brought to the Museum as organized classes, and many of them are assigned definite work in the Museum, spending day after day in the task of studying the collections, describing the objects which are placed before them, and making drawings of the same. The Director has had the opportunity of looking over the notebooks of some of the one hundred and thirty students from the University of Pittsburgh who are studying zoölogy in that institution, and has been very much pleased to see the evidence given not merely of the power to observe accurately, but in some cases to delineate beautifully the objects which are being studied. It surely will be an advantage to these young people in future years to recall the time which they passed within these walls studying the truths of nature.

### XIII. A LIST OF THE LAND AND FRESH-WATER SHELLS OF THE ISLE OF PINES.

BY JOHN B. HENDERSON.

The Isle of Pines has been visited by most of the collectors of land-shells interested in the Cuban fauna, and its list of known mollusks has been fairly complete from early times. It is quite likely, however, that careful search would bring to light some of the smaller species common on the adjoining large island, but as yet unrecorded in the census of the Isle of Pines. Among such are the Zonitidæ, the Pupidæ, some of the smaller Stenogyridæ, and several fresh-water species of somewhat wide distribution.

A large proportion of the species of the island are confined to the two small ranges of limestone mountains in the extreme northern part, known as the Sierra de Casas and the Sierra de Caballos. Of the latter there is an extension in the form of an elevated peninsula with steep sides, which projects into the sea, and is known as Punta del Colombo. The other mountains of the island, such as the Cañada Range and the elevations back of Santa Fé, are of limestone crystallized into a hard marble, and therefore offer but poor stations for mollusks. The southern portion of the island, separated by a swamp from the northern half, offers a good station for a restricted group of land-snails, which flourish amid the conditions presented by a flat porous limestone covered by scrubby forest-growths. But little has been reported from this region, as it is inaccessible and of no interest to travellers. It is most probable that its fauna will prove to be quite the same as that encountered along the coastal strip in Cuba, where conditions are very similar. The following list includes all the species so far recorded from the island with the addition of a few in my collection taken by myself or by Dr. Nicholas.

#### I. *Megalomastoma procer* Poey.

*M. procer* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1854, p. 404, Pl. 13, figs. 12-18.

*Habitat*.—Casas and Caballos Mountains.

Usually darker in color than the closely allied *M. mani* Poey, which occurs in the Organ Mountains of western Cuba.



**2. *Rhytidopoma rugulosum* (Pfeiffer).**

*Cyclostoma rugulosum* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 356.

*Habitat*.—Casas and Caballos Mountains; Punta de Colombo.

This species is the type of the genus *Ctenopoma* Shuttleworth (1856) preoccupied (1855). The generic name here used was substituted by Sykes (1901).

**2a. *Rhytidopoma rugulosum clathratum* Gould.**

*Cyclostoma clathratum* GOULD, Boston Journal Nat. Hist., Vol. IV, 1842, on cover (no page).

Reported from the Isle of Pines by Arango and authors under the specific name *denegatum* Poey (1856). There can be no doubt of the specific identity of *denegatum* Poey and *clathratum* Gould, the latter name having priority.

**2b. *Rhytidopoma rugulosum nodulatum* (Poey).**

*Cyclostoma nodulatum* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1852, p. 104.

A specimen in my collection derived from Poey is marked as from the Isle of Pines. I have seen no others, and believe the record needs confirmation.

**3. *Chondropoma dissolutum* (Pfeiffer).**

*Cyclostoma dissolutum* PFEIFFER, Malakozoologische Blätter, Vol. I, 1854, p. 158. Novit. Conch., Vol. I, p. 95, Pl. 26, figs. 12–16.

*Habitat*.—Casas and Caballos Mountains; Punta del Colombo.

**[“*Cyclostoma*” *semicanum* Morelet.**

A species described by Morelet in Test. Novissima Ins. Cub., Pt. 2, 1851, p. 20, and erroneously ascribed to the Isle of Pines. It is probably *Annularia blaini* (Gundlach) Pfeiffer, Mal. Blätt., Vol. 10, 1862, p. 197, of the Organ Mountains of Pinar del Rio, Cuba.]

**4. *Chondropoma wilcoxi* Henderson, subsp.**

*Chondropoma wilcoxi* HENDERSON, Nautilus, Vol. XXVI, 1912, p. 45; *l. c.*, Vol. XXVII, 1913, Pl. 3, fig. 1.

*Habitat*.—Caripatchibey (?). Probably southern coast.

A lot collected by Dr. Nicholas in my collection are evidently referable to *C. wilcoxi*, although not typical. The type is from the Ensenada de Cochinos in Cuba and not from the Isle of Pines where the conditions of environment are identical. These shells are smaller and of slightly heavier texture.

5. *Tudora moreletiana* (Petit).

*Cyclostoma disjunctum* MORELET, Test. Nov. Ins. Cub., No. 58, 1849 (*Preocc.*).

—*Cyclostoma moreletianum* PETIT, Journal de Conchyliologie, Vol. I, 1850, p. 46.—*Cyclostoma moreletianum* PFEIFFER, in Martini & Chemnitz, Syst. Conch. Cab. (*Cyclostoma*) Pl. 37, figs. 27-28.

*Habitat*.—Casas Mountains.

6. *Tudora pupoides* (Morelet).

*Cyclostoma pupoides* MORELET, Test. Nov., Vol. I, 1849, p. 23; POEY, Memorias.

Hist. Nat. Cuba, Vol. II, 18—, Pl. 3, fig. 17.

*Habitat*.—Caballos Mountains, Punta del Colombo.

Until a revision of the Antillean operculates can be made, the systematic position of this and the preceding species must remain uncertain. In both the development of a breathing syphon at the upper angle of the aperture is to be observed. This character suggests Dr. Dall's genus *Opisthosiphon* (Proc. Mal. Soc., Vol. VI, 1905, p. 209) provided that genus can be maintained. The critical character of *Opisthosiphon* is one which to some degree is present in other operculate genera, and to include all species possessing such a breathing arrangement would seem to do violence to other characters of more basic generic importance.

7. *Priotrochatella constellata* (Morelet).

*Helicina constellata* MORELET, Revue Zoologique, 1847, p. 144; Test. Nov., p. 21.—*Trochatella constellata* PFEIFFER, in Martini & Chemnitz, Syst. Conch.

Cab (*Helicinaceen*), Pl. 9, figs. 40-41.—*Priotrochatella constellata* WAGNER, in Martini & Chemnitz, Syst. Conch. Cab. (*Helicinaceen*), 1911, p. 16.

*Habitat*.—Casas Mountains.

8. *Priotrochatella stellata* (Velasquez) (Poey).

*Helicina stellata* VELASQUEZ, in Jay's Catalog, 1850, p. 262, (name only).—

*Helicina stellata* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1852, p. 117; Pl. 5, figs. 18-20.—*Priotrochatella stellata* WAGNER, Denks. Akad. Wien, Vol. LXXVII, 1905, p. 370, Pl. I, figs. 25a and b, F. 16.—MARTINI & CHEMNITZ (*Helicinaceen*), 1911, p. 17, Pl. I, fig. 4 and Pl. 2, figs. 12-13.

*Habitat*.—Caballos Mountains; Punta del Colombo.

This and the preceding species are two of the most remarkable land-shells of Cuba, both by reason of their bizarre form and their apparently isolated position in the assemblage of Antillean operculates. Notwithstanding this, the inclusion of the genus in an oriental subfamily of Helicinids, suggested by Fischer (Journ. de Conch., Vol. XLIV, p. 88) and adopted by Wagner, needs careful scrutiny.

9. **Eutrochatella (Ustronia) scopulorum** (Morelet).

*Helicina scopulorum* MORELET, Test. Nov. Ins. Cub., 1849, p. 20.—*Helicina luteoapicata* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1854, p. 394.—*Eutrochatella (Ustronia) scopulorum* WAGNER, in Martini & Chemnitz, Syst. Conch. Cab. (Helicinaceen), 1911, p. 120, Pl. 24, figs. 16-18, 22-23.

*Habitat*.—Casas and Caballos Mountains.

An abundant species on the walls, "paradones," of the mountains. It belongs to the group of *E. straminea* Morelet and *E. acuminata* Velasquez of the Organ Mountains of Cuba. Poey's *E. luteoapicata* is scarcely worthy of subspecific rank.

10. **Eutrochatella (Artecallosa) elongata** (D'Orbigny).

*Helicina elongata* D'ORBIGNY, in Sagra Moll. Cuba, Vol. I, 1841, p. 251, Pl. 20, figs. 16-18.—*Eutrochatella (Artecallosa) elongata* WAGNER, in Martini & Chemnitz, Syst. Conch. Cab. (Helicinaceen), 1911, p. 135; Pl. 23, figs. 1-4.

A widely distributed species of western Cuba. Specimens in my collection from Poey, ascribed to the Isle of Pines, are my only authority for its inclusion in this list.

11. **Eutrochatella (Artecallosa) callosa** (Poey).

*Helicina callosa* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1854, p. 430, Pl. 33, figs. 13-14.—*Eutrochatella (Artecallosa) callosa* WAGNER, in Martini & Chemnitz, Syst. Conch. Cab. (Helicinaceen), 1911, p. 137, Pl. 22, figs. 25-28.

*Habitat*.—Casas Mountains, on rocky cliffs.

12. **Helicina adspersa** Pfeiffer.

*Helicina adspersa* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 354.—*Helicina adspersa* WAGNER, in Martini & Chemnitz, Syst. Conch. Cab. (Helicinaceen), 1911, p. 322, Pl. 63, figs. 25-28.

*Habitat*.—Casas Mountains.

This species, so widely distributed throughout central and western Cuba, is represented in my collection from the Isle of Pines by a single specimen taken on the Casas Mountains. It is smaller than the average, but otherwise typical. The many color-varieties of this pretty little shell have brought to it many names. The specific names *variegata* D'Orbigny, *marmorata* D'Orbigny, *tenuilabris* Pfeiffer, *ornata* Férussac, applied to it, are all synonyms.

13. **Proserpina globulosa** D'Orbigny.

*Proserpina globulosa* D'ORBIGNY, in Sagra, Moll. Cuba, Vol. I, 1841, p. 239, Pl. 18, figs. 8, 11.

*Habitat*.—Casas and Caballos Mountains; Punta del Colombo.

14. *Oleacina* (*Lævoleacina*) *oleacea straminea* (Deshayes).

*Achatina straminea* DESHAYES, in Férussac, Hist. Nat. Moll. Terr. & Fluv., Vol. II, 1851, p. 172, Pl. 123, figs. 11-12.—*Oleacina oleacea straminea* PFEIFFER, Nov. Conch., p. 318, Pl. 77, figs. 3-4; PILSBRY, Manual of Conchology, Vol. XIX, 1907, p. 138, Pl. 33, figs. 5, 9.

*Habitat*.—Casas Mountains; probably also Caballos Mountains and Punta del Colombo.

Not distinguishable from forms found about Havana and Matanzas. One specimen taken by Dr. Nicholas (exact locality not given) measures only 19 mm. by 8 mm., though fully adult. It is of very dark color.

15. *Oleacina* (*Lævoleacina*) *solidula* (Pfeiffer).

*Polyphemus solidulus* PFEIFFER, Wieg. Archiv, Vol. I, 1840, p. 252.—*Oleacina solidula* PILSBRY, Manual of Conchology, Vol. XIX, 1907, p. 140, Pl. 33, figs. 3-4.

*Habitat*.—Casas and Caballos Mountains; Punta del Colombo.

Taking the form found about Matanzas as the true species, none of those from the Isle of Pines are wholly typical.

16. *Oleacina* (*Lævoleacina*) *follicularis* (Morelet).

*Glandina follicularis* MORELET, Test. Nov. Ins. Cub., 1849, p. 14.

*Habitat*.—Casas Mountains.

The extremes of this and the preceding species are readily distinguishable, but a number of intermediates connect, so that it is difficult to determine where one begins and the other ends. Typical *O. follicularis* has a shorter antepenult whorl, a less sharply descending last whorl, a narrower and longer aperture and the columella is straighter. Specimens from the Caballos Mountains and Punta del Colombo generally belong to the intermediate forms. Morelet's type evidently came from the Casas Mountains.

17. *Oleacina* (*Lævoleacina*) *subulata* (Pfeiffer).

*Polyphemus subulatus* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 352.

*Habitat*.—Casas and Caballos Mountains; Punta del Colombo.

The inadequate Latin descriptions applied to these small Cuban *Oleacinas* by their authors has made critical identification extremely difficult. Assuming Matanzas to be the type-locality, the shells from the Isle of Pines certainly belong to this species.

18. *Spiraxis* (*Glandinella*) *poeyanus* (Pfeiffer).

*Bulimus poeyanus* PFEIFFER, Malakozoologische Blätter, Vol. I, 1854, p. 157.—

*Spiraxis* (*Glandinella*) *poeyanus* PILSBRY, Manual of Conchology, Vol. XIX, 1907, p. 45, Pl. 3, figs. 37-38.

*Habitat*.—Casas and Caballos Mountains; Punta del Colombo.

[*Obeliscus strictus* (Poey).

*Bulimus strictus* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1853, p. 205.

An eastern Cuban species reported by Poey to have been found in the Isle of Pines. The record needs confirmation.]

19. *Urocoptis* (*Gongylostoma*) *pruinosa* (Morelet).

*Cylindrella pruinosa* MORELET, Test. Nov., Ins. Cub., Vol. I, 1849, p. 11.—

*Urocoptis* (*Gongylostoma*) *pruinosa* PILSBRY, Manual of Conchology, Vol. XV, 1903, p. 260, Pl. 54, figs. 74-76.

*Habitat*.—Casas and Caballos Mountains.

20. *Pineria beathiana* Poey.

*Pineria beathiana* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1854, p. 430, Pl. 34, figs. 17-18; PILSBRY, Manual of Conchology, Vol. XVI, 1904, p. 110, Pl. 1, fig. 9.

*Habitat*.—Caballos Mountains.

21. *Pineria terebra* Poey.

*Pineria terebra* POEY, Memorias Hist. Nat. Cuba, Vol. I, 1854, p. 429, Pl. 34, figs. 12-16; PILSBRY, Manual of Conchology, Vol. XVI, 1904, p. 110, Pl. 1, figs. 3-4.

*Habitat*.—Casas Mountains (Gundlach); Punta del Colombo, attached to the roots of dead agave plants.

22. *Liguus fasciatus* (Müller).

*Buccinum fasciatum* MÜLLER, Verm. Terr. Fluv., Vol. II, 1774, p. 145.

*Liguus fasciatus* PILSBRY, Manual of Conchology, Vol. XII, 1899, p. 166, Pl. 57-60.

*Habitat*.—Casas and Caballos Mountains; Punta del Colombo; probably the scrub forests of the south coast.

Specimens in my collection show relationships with both the long slender forms of Pinar del Rio and the stouter forms of Havana and Matanzas, and by their color-patterns indicate a mixture of several well-marked races.

23. *Cerion pineria* Dall.

*Cerion* (*Maynardia*) *pineria* DALL, Proceedings U. S. National Museum, Vol. XVIII, 1895, p. 6; PILSBRY, Manual of Conchology, Vol. XIV, 1902, p. 198, Pl. 32, fig. 20.



*Habitat*.—The exact locality of this diminutive *Cerion* has not been given.

24. **Thysanophora boothiana** (Pfeiffer).

*Helix boothiana* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 351.

*Habitat*.—Casas and Caballos Mountains, Punta del Colombo. Probably occurring throughout the island.

Specimens taken on the Casas and Caballos Mountains are all smaller than the typical forms of the Matanzas region and belong to a race found in the district of the Organ Mountains of Pinar del Rio. The constantly smaller size and coarser texture with deeper sutures entitle the group to subspecific rank. I suggest the name *pinarensis*.

25. **Polygyra paludosa** (Pfeiffer).

*Helix paludosa* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 350.—*Helix ramonis* D'ORBIGNY, in Sagra, Moll. Cuba, Vol. I, 1841, p. 142, Pl. 8, figs. 1-4.

*Habitat*.—Nueva Gerona, and probably throughout the island.

This species is well supplied with names. Among them are *lingulata* Férussac, *insularum* Beck, *bardenflehti* B. Villa, etc.

26. **Pleurodonte (Thelidomus) auricoma** (Férussac).

*Helix auricoma* FÉRUSSAC, Hist. Nat. Moll., XVIII, 1819, Pl. 46, figs. 7, 9.—*Pleurodonte (Thelidomus) auricoma* PILSBRY, Manual of Conchology, Vol. IX, 1894, p. 97; *op. cit.*, Vol. V, 1889, p. 62, Pl. 3, figs. 26-30.

*Habitat*.—Casas Mountains, Nueva Gerona; probably more or less over the whole island.

27. **Cepolis (Jeanneretia) multistriata pityonesica** (Pfeiffer).

*Helix pityonesica* PFEIFFER, Mal. Blätt., 1854, p. 156.—*Cepolis (Jeanneretia) multistriata pityonesica* PILSBRY, Manual of Conchology, Vol. V, 1889, p. 49, Pl. 10, fig. 94, & Pl. 32, fig. 60; *op. cit.*, Vol. IX, 1894, p. 180.

*Habitat*.—Caballos and Casas Mountains.

28. **Cepolis (Cysticopsis) comes** (Poey).

*Helix comes* POEY, Memorias Hist. Nat. Cuba, Vol. II, 1854, p. 29.—*Cepolis (Cysticopsis) comes* PILSBRY, Manual of Conchology, Vol. V, 1889, p. 11; *Op. cit.*, Vol. IX, 1894, p. 187.

*Habitat*.—Caballos Mountains.

29. **Galba cubensis** (Pfeiffer).

*Limnæa cubensis* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 354.—*Galba cubensis* BAKER, Lymnæidæ, 1911, p. 204.

*Habitat*.—Swamp near Nueva Gerona. Probably occurring in all fresh-waters of the island.

30. **Planorbis lucidus** Pfeiffer.

*Planorbis lucidus* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 354.

*Habitat*.—"Isle of Pines" (Morelet). Swamp near Nueva Gerona.

This is the *P. lanieriana* of D'Orbigny, *P. taniatus* of Morelet, and *P. redfieldi* of Adams (Jamaica).

31. **Physa cubensis** Pfeiffer.

*Physa cubensis* PFEIFFER, Wieg. Archiv, Vol. I, 1839, p. 354.

*Habitat*.—Isle of Pines (Dr. Nicholas).

32. **Ancylus radiatilis** Morelet.

*Ancylus radiatilis* MORELET, Test. Nov. Ins. Cub., Vol. II, 1849, p. 17.

*Habitat*.—"Isle of Pines."

33. **Ampullaria reflexa** Swainson. (Cf. Tilloch, Phil. Mag., Vol. 61, p. 337).

*Habitat*.—"North side of island." (Dr. Nicholas.) Probably in the "Cienega" or swamp of the central part. Said by the natives to be abundant in the river above Nueva Gerona. These specimens correspond with the large globose form from the interior of Cuba and are of a uniform light olive color, being the species generally accepted as "*reflexa*." Doubt attaches to all the names applied to the *Ampullarias* of Cuba.

34. **Amnicola coronata** Pfeiffer.

*Amnicola coronata* PFEIFFER, Wieg. Archiv, Vol. I, 1840, p. 253.

*Habitat*.—River above Nueva Gerona.

35. **Cyrenella americana** (Morelet).

*Cyrenoides americana* MORELET, Test. Nov. Ins. Cub., Vol. II, 1849, p. 26.

*Habitat*.—"Isle of Pines" (Morelet).

The following table indicates the distribution of the species enumerated in this List of Species from the Isle of Pines:

Of the twenty-eight species of land-snails recorded in this list (omitting the very questionable *Obeliscus strictus*) it appears that

Isle of Pines Only.	Land-shells.	Pinar del Rio.	Havana.	Matanzas.	Oriente.	Other Islands.
×	<i>Megalomastoma procer</i> Poey.....					
	<i>Rhytidopoma rugulosum</i> (Pfeiffer).....	×	×	×		
	<i>Rhytidopoma rug. clathratum</i> Gould.....	×		×		
	<i>Rhytidopoma rug. nodulatum</i> (Poey).....		×			
×	<i>Chondropoma dissolutum</i> (Pfeiffer).....					
	<i>Chondropoma wilcoxi</i> (var.) Henderson..	Type from Ensenada de Cochinos				
×	<i>Tudora moreletiana</i> (Petit).....					
×	<i>Tudora pupoides</i> (Morelet).....					
×	<i>Priotrochatella constellata</i> (Morelet).....					
×	<i>Priotrochatella stella</i> (Poey).....					
×	<i>Eutrochatella scopulorum</i> (Morelet).....					
	<i>Eutrochatella elongata</i> (Orbigny).....	×				
×	<i>Eutrochatella callosa</i> (Poey).....					
	<i>Helicina adspersa</i> Pfeiffer.....	×	×	×	?	
	<i>Proserpina globulosa</i> Orbigny.....	×	×	×	×	
	<i>Oleacina olacea straminea</i> (Deshayes)....	×	×	×	?	Bahamas
	<i>Oleacina solidula</i> (Pfeiffer).....	×	×	×		Bahamas
×	<i>Oleacina follicularis</i> (Morelet).....					
	<i>Oleacina subulata</i> (Pfeiffer).....	×	×	×	?	
×	<i>Spiraxis poeyana</i> Pfeiffer.....					
	<i>(Obeliscus strictus)</i> (Poey).....				×	
×	<i>Urocoptis pruinosa</i> (Morelet).....					
×	<i>Pinaria beathiana</i> Poey.....					
×	<i>Pinaria terebra</i> Poey.....					
	<i>Liguus fasciatus</i> (Müller).....	×	×	×	×	Florida
×	<i>Cerion pinaria</i> Dall.....					
	<i>Thysanophora boothiana</i> (Pfeiffer).....	×	×	×	×	?
	<i>Polygyra paludosa</i> (Pfeiffer).....	×	×	×	×	
	<i>Pleurodonte auricola</i> (Férussac).....	×	×	×	×	Bahamas
×	<i>Cepolis multistriata pityonesica</i> (Pfeiffer)..					
×	<i>Cepolis comes</i> (Poey).....					
<i>Fresh-water shells.</i>						
	<i>Galba cubensis</i> (Pfeiffer).....	×	×	×	×	Antilles, U.S.
	<i>Planorbis lucidus</i> Pfeiffer.....	×	×	×	×	Jamaica
	<i>Physa cubensis</i> Pfeiffer.....	×	×	×	×	
×	<i>Ancylus radiatilis</i> Morelet.....					
	<i>Ampullaria reflexa</i> Swainson.....		×	×		
	<i>Amnicola coronata</i> Pfeiffer.....	×	×	×	×	Antilles
	<i>Cyrenella americana</i> (Morelet).....					Antilles

sixteen, or over half the total, are peculiar to the island. Of the seven fresh-water species only one carries no other locality records. This one, the *Ancylus* of Morelet, is probably a synonym of some of the other more widely distributed species of that genus.

Eleven species of land-snails are also from Pinar del Rio and an equal number are of the Havana-Matanzas region. Those from the eastern

part of Cuba as well as the Isle of Pines are species of generally wide distribution throughout the larger island. It is clear, therefore, that the molluscan fauna of the Isle of Pines is a composite of the Western Cuban forms which migrated at the time of a land-connection between the two islands. Since the separation in comparatively recent time there has been an isolation sufficient to develop on the lesser island a faunal or separate element. In the case of almost every species this relationship is obvious and is often very close. The case of the two *Priotrochatellas* is not clear. This is an example of remarkable development along a particular line, or these two species are of exotic origin. The former is likely the case.

#### XIV. THE PELECYPODA OF THE CHAZY FORMATION.

BY PERCY E. RAYMOND.

The present paper is the eighth, and probably the last, of a series of papers in which the writer has dealt with the fauna of the Chazy formation of New York, Vermont, and Ontario. Six of these papers are published in these ANNALS, the first being entitled, "The Trilobites of the Chazy Limestone,"<sup>1</sup> and the others, in order, "The Chazy Formation and its Fauna,"<sup>2</sup> "The Gastropoda of the Chazy Formation,"<sup>3</sup> "New and Old Trilobites from the Chazy,"<sup>4</sup> and "The Brachiopoda and Ostracoda of the Chazy."<sup>5</sup> The present paper is the sixth.

The two papers not published in the ANNALS contain little which is not given in the above papers. The first, "The Fauna of the Chazy Limestone,"<sup>6</sup> contained a summary of the results of the study published in the ANNALS as "The Chazy Formation and its Fauna." The other paper, "The Trilobites of the Chazy in Vermont,"<sup>7</sup> is a revised and corrected compilation of the two papers on Chazy trilobites published in these ANNALS, and contains all the plates of both papers.

Since the writer began publishing on this fauna, two authors have made valuable contributions to our knowledge of the fossils of the Chazy. Dr. Ruedemann has published an extremely good account of the Cephalopoda<sup>8</sup> and Professor Hudson, in several articles, has dealt extensively and in detail with the Echinoderms. Professor Hudson's persevering work on the decomposed material in the fault on Valcour Island has been rewarded by the discovery of a great variety of very interesting specimens, and his remarkable genius for detail has enabled him to derive a great amount of information from his spoils. His most remarkable find was the nearly complete speci-

<sup>1</sup> ANNALS CARNEGIE MUSEUM, Vol. III, 1905.

<sup>2</sup> Vol. III, 1906.

<sup>3</sup> Vol. IV, 1908.

<sup>4</sup> Vol. VII, 1910.

<sup>5</sup> Vol. VII, 1911.

<sup>6</sup> *American Journal of Science*, Vol. XX, 1905.

<sup>7</sup> Seventh Report Vermont State Geologist, 1910.

<sup>8</sup> Bull. 90, N. Y. State Museum, 1906, pp. 393-528, Pls. 1-38.



men of *Blastoidocrinus carchariædens* which he has so carefully described and beautifully figured. The titles of Professor Hudson's papers follow, and it should be noted that his work is still incomplete, as he has still in hand a very considerable number of Cystids:

"Contributions to the Fauna of the Chazy Limestone on Valcour Island, Lake Champlain";<sup>9</sup> "On Some Pelmatozoa from the Chazy Limestone of New York";<sup>10</sup> "Studies of Some Early Siluric Pelmatozoa."<sup>11</sup>

Dr. Bassler, of the U. S. National Museum, several years ago undertook the study of the Bryozoa of the Chazy, but has not so far found time to complete the work. Although a considerable amount of material is available, it is, like most of the other fossils of the Chazy, in an indifferent state of preservation, and requires an unusual amount of time for its elucidation.

#### FIELD-WORK.

Field-work on this formation by the writer practically ceased after the summer of 1903, and I have, therefore, not so much as might be expected to say in correction of my earlier work. Fortunately I was able to spend a few weeks in 1910 and 1911 on the Chazy of the Ottawa Valley and in the region in Quebec north of the Champlain Valley, and it proves necessary to make changes in our previous views of the strata in those regions.

#### CHAZY IN THE OTTAWA VALLEY.

As the writer has set forth in detail elsewhere,<sup>12</sup> the Chazy formation of the "Geology of Canada," 1863, proved on further examination to be composed of two formations, the lower one of which is of Upper Chazy age, while the upper formation belongs to the Lowville-Black River series, and is to be correlated with the Pamelia formation in New York. This upper part corresponds to the Chazy limestone of Logan and Ells, and very nearly to the Aylmer limestone of my papers of 1905 and 1906. With the removal of this formation from the Chazy, the following fossils must be removed from the list of Chazy species: *Helicotoma whiteavsiana*, Raymond; *Sowteria canadensis*, (Raymond); *Modiolopsis breviscula*, Billings; *Ctenodonta parvidens*,

<sup>9</sup> Report New York State Paleontologist for 1903-1904, pp. 270-295, pls. 1-5.

<sup>10</sup> Bull. 107, N. Y. State Museum, 1907, pp. 97-131, Pls. 1-10.

<sup>11</sup> Bull. 149, N. Y. State Museum, 1911, pp. 195-258, Pls. 1-7.

<sup>12</sup> *Ottawa Naturalist*, Vol. XXIV, 1911, p. 189.

Raymond; *Beyrichia? clavigera*, Jones; *Beyrichia? clavigera clavifracta*, Jones; *Isochilina ottawa intermedia*, Jones; *Isochilina labellosa*, Jones; *Leperditia amygdalina*, Jones.

An examination of the strata exposed at Grenville, Quebec, and at the mouth of the Little Rideau River a few miles below Grenville, shows that the ostracod- and trilobite-bearing limestone there is not the same as the "Chazy limestone" (Pamelia) at L'Original and Ottawa, but lies beneath the Chazy, and belongs to the Beekmantown. This necessitates the removal of the following species from the Chazy to the Beekmantown: *Bathyrurus angelina*, Billings; *Leperditia canadensis*, Jones; *Primitia logani*, Jones; *Isochilina ottawa*, Jones.

This removes what had been one of the anomalies of the Chazy fauna, namely, the *Bathyrurus*. *Bathyrurus* is one of the strictly American genera, and its presence is usually an indication that the fauna is that of the interior sea. The other trilobites of the Chazy, on the other hand, are European or cosmopolitan genera, and the fauna as a whole is of the Atlantic facies.

At a later date, the Atlantic, or Arctic and interior faunas mingled, and we have in the Black River *Bathyrurus* associated with such European genera as *Basilicus*.

#### CHAZY OF QUEBEC AND THE MINGAN ISLANDS.

The writer had occasion, in the summers of 1910 to 1912, to go over most of the exposures of the Chazy in the province of Quebec, except the Mingan Islands, and was surprised to find that nowhere were there exposures of strata older than the Upper Chazy of the section in the Champlain Valley.

The so-called Chazy in the section between Philipsburg and St. Armand contains no Chazy fossils, and belongs to the Beekmantown. The "Chazy slates" of Ells<sup>13</sup> at Mystic and vicinity are the shales and conglomerates of the Levis formation. The strata referred to the Chazy at St. Dominique belong to the upper division of the Chazy. The limestones at Caughnawaga, St. Martins Junction, Mile End, and elsewhere in the vicinity of Montreal all belong to the Upper Chazy, and have a sandstone at the base, this sandstone resting on the Beekmantown without the intervention of any strata which can be correlated with the Middle or Lower Chazy. At Joliette, fifty miles northeast of Montreal, the Chazy is a thin sandy limestone with a small fauna.

<sup>13</sup> Ann. Rept. Geol. Survey Canada, Vol. VII, 1896, pt. J, p. 34.

Twenhofel and Schuchert<sup>14</sup> have recently re-investigated the section on the Mingan Islands, and find that all the strata, which are there referable to the Chazy, are of Upper Chazy age.

It seems then, that the Middle and Lower Chazy are developed only within the limited area between Ticonderoga and the foot of Lake Champlain, and that the view that this fauna entered the continent along a channel which roughly corresponded to the St. Lawrence trough is no longer tenable. The fauna could not have come from the west, and with the St. Lawrence depression eliminated, the only other directions are the south and east. The Chazy is present in eastern Tennessee and Virginia, but is missing from the intervening states of Maryland, Pennsylvania, New Jersey, and New York as far as Ticonderoga. At the most southern exposures in New York it is the Middle and not the Lower Chazy which rests upon the pre-Chazy formation, so that the chances that the Chazy entered from that direction are very small. It would seem that the only chance for a connection with the Atlantic was from the East, directly across the Green Mountains, and the sediments of that region are, unfortunately, so metamorphosed, that it is impossible to trace the formation in that direction. There do not seem to be any reasons why the Chazy sea should not have invaded the continent from that direction, and, to the writer, such a land and sea pattern seems more natural than the long narrow fiords which have been premised by recent writers. It seems more probable that the long narrow tracts of strata now exposed are the results of the accidents of earth-movements, in which the strata have been fractured and in-faulted in long narrow zones approximately parallel to the coast line.

## THE PELECYPODA.

### INTRODUCTION.

Pelecypods are not very numerous in the Chazy and they are almost always badly preserved. Usually they occur as casts of the exterior, and thus do not preserve any indications of the hinge-structure or of the muscle-scars. Under such circumstances, accurate determination of the genus is practically impossible, and comparison with other known species is generally useless. Of the species herein described, only three show enough of the internal structure to be of any value,

<sup>14</sup> Bull. Geol. Soc. America, Vol. 21, 1910, p. 677.

and only two, or possibly three, show the true exterior outline and contours.

*Modiolopsis fabaformis* and *Conocardium beecheri* are rather common, and both belong to the upper division of the Chazy, and so are fairly useful as horizon-markers. Several of the species are described from unique specimens, and the *Clionychias* and *Ctenodontas*, which are relatively common, seem to have a long range, and occur at any horizon.

#### HISTORICAL.

The Pelecypods of the Chazy have, with the exception of the Bryozoa, been the most neglected of all its fossils. Until the appearance of Professor Hudson's paper in 1904, only five species had been described, and of these, two had not been figured. Hall in his description of the Chazy fauna in Volume I of the "New York State Paleontology" (1847) did not describe any lamellibranch, but in the "Additions and Corrections" on page 315 he briefly described *Ambonychia mytiloides*, an unrecognizable form, possibly the same as *Clionychia montrealensis*.

Billings, in an article on "Some Silurian and Devonian Fossils of Canada"<sup>15</sup> described *Cyrtodonta subcarinata* from the "Chazy, Birds-eye, Black River limestones, and in the base of the Trenton," at Pointe Claire and numerous localities in the Ottawa Valley.

The next year, in his "Fossils of the Chazy Limestone"<sup>16</sup> the same author says: "The fossils [Lamellibranchiata] are rare in the Chazy limestone, yet the species seem to be somewhat numerous. I think I can make out 17 species belonging to *Ctenodonta*, *Cyrtodonta*, *Vanuxemia*, *Modiolopsis*, and probably two or three other genera. As the specimens consist mostly of casts, they must remain undescribed until better can be procured."

He then describes the following: *Modiolopsis parviuscula*, *Vanuxemia montrealensis*, *Cyrtodonta breviuscula*; and mentions *Ctenodonta nasuta*, Hall, as occurring in the Chazy.

It is significant that he does not include in this list the *Cyrtodonta subcarinata*, described by him the preceding year, and the present writer takes this to mean that on closer study he failed to identify any of the Chazy forms with the shell he described in 1858. The

<sup>15</sup> *Canadian Naturalist and Geologist*, Vol. III, 1858, p. 433, figs. 5-7.

<sup>16</sup> *Can. Nat. and Geol.*, Vol. IV, 1859.

typical specimens of that species were from the Black River (Lowville division) at Pointe Claire and Osnabruck.

The *Ctenodonta nasuta* of Billings was probably a different species from that described by Hall, and may be the *Ctenodonta parvidens* or *C. peracuta* of the present paper.

In Professor Hudson's paper,<sup>17</sup> two more lamellibranchs are described. These are *Modiolopsis subquadrilateralis* and *Cyrtodonta? lamellosa*, both small and rare species, so far found only at the type-locality.

In 1905 the writer<sup>18</sup> described, without figures, thirteen species of pelecypods, which he supposed were from the Chazy, but further study has shown that two of them were from the overlying formation. In 1906<sup>19</sup> he added four more species, also without illustrations.

In 1908, Dr. J. F. Whiteaves<sup>20</sup> described several pelecypods supposed to have come from the Chazy, but recent field-work has shown that most of these, including all his new species, were derived from the Pamelaia. In this paper, *Modiolopsis parviuscula* and *Cyrtodonta breviuscula* were figured for the first time.

#### Sub-Kingdom **MOLLUSCA** Linnæus.

#### Class **PELECYPODA** Goldfuss.

#### Order **PRIONODESMACEA** Dall.

#### Family **CTENODONTIDÆ** Dall.

#### Genus **Ctenodonta** Salter.

#### 1. **Ctenodonta peracuta** Raymond. (Plate XXIX, figures 1-3.)

Cf. *Nucula levata* HALL, Paleontology New York, Vol. I, 1847, p. 150, figs. 1f-i.  
*Ctenodonta levata* RAYMOND, Bulletin of American Paleontology, Vol. III, 1902, No. 14, pp. 14, 15, 19. (In lists.)

*Ctenodonta peracuta* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 371.

Since this species was originally described, a fragment of a free shell has turned up in the loose material in the fault on Valcour

<sup>17</sup> Report of the N. Y. State Paleontologist for 1903 (1904), p. 286.

<sup>18</sup> *American Journal of Science*, Vol. XX, (Ser. 4), 1905, pp. 371-374.

<sup>19</sup> ANNALS CARNEGIE MUSEUM, Vol. III, 1906, pp. 577, 578.

<sup>20</sup> *Ottawa Naturalist*, Vol. XXII, 1908, p. 105.



Island. All the other specimens, which are fairly numerous, are casts of the exterior of single valves. In the present paper, the shorter and higher end of the shell is called the front of *Ctenodonta*, while in the original description, the longer end, toward which the beaks point, was considered the front.

*Description.*

Shell small, depressed convex, thickest at the umbos, longer than high, the beak situated at about one-third the length. The posterior end is somewhat drawn out, as in *Ctenodonta nasuta* Hall. Greatest convexity at the umbo, the anterior slope steep, posterior slope very gradual. Both slopes to the hinge abrupt, but that to the basal margin gentle. The interior of a right valve shows the teeth in a gently curved, uninterrupted series, nine teeth in front, and seven behind the beak. A large specimen is 12 mm. long and 9 mm. high.

This species resembles those specimens of *Ctenodonta levata* (Hall) which are represented by figures 1*f* to 1*i* of the plate cited in the synonymy we have given, but are unlike figures 1*a* to 1*c*. There seem to be fewer teeth on the hinge than in *C. levata*.

*Locality*.—Rather common in the trilobite layers of the Middle Chazy on Valcour Island, and at the same horizon at Crown Point. Also in the Upper Chazy on Valcour Island.

2. ***Ctenodonta dubiaformis*** Raymond. (Plate XXIX, figure 6.)

*Ctenodonta dubiaformis* RAYMOND, American Journal of Science, (Ser. 4), Vol. XX, 1905, p. 371.

The outline of this species resembles the smaller specimens of *Ctenodonta dubia* figured by Hall, and it plainly belongs to the same group. It is, however, higher in proportion to the length.

*Description.*

Shell small, moderately convex, beak sub-central. Greatest convexity at the umbo, the slope from it to the base being nearly flat. Basal margin nearly straight. Posterior end nasute, and a little longer than the anterior end, which is regularly rounded.

All the specimens are casts, without trace of hinge teeth, muscle scars, or surface markings. The largest specimen is 19 mm. long and 10.5 mm. high. Another is 17 mm. long and 9 mm. high.

*Locality*.—Sloop Bay, Valcour Island, in the middle of the Chazy.

3. **Ctenodonta ? bidorsata** Raymond. (Plate XXIX, figures 4, 5).

*Ctenodonta? bidorsata* RAYMOND, Annals Carnegie Museum, Vol. III, 1906, p. 577.

This small shell has something of the general shape of a *Ctenodonta*, and for lack of knowledge of what it really is, it is placed in that genus. The specimen shown in figure 4 of the plate has somewhat the appearance of a *Pterotheca expansa*, though it has no keel.

*Description.*

Shell small, longer than high. Hinge back of beak nearly straight, rather long. End of shell in front of beak short and broadly rounded. Lower margin gently curved. Posterior end short and rather acute. The internal cast is marked by two narrow sinuses which radiate from the beak. The distal end of the anterior one is nearly opposite the beak, while the posterior one runs diagonally across to the posterior-ventral angle of the shell. In front of the anterior sinus and behind the posterior one there is a narrow ridge. The valves are only slightly convex, highest at the umbo, and concave along the hinge margin. One specimen is 11 mm. long and 7 mm. high.

*Locality.*—A rare species in the trilobite layers of the Middle Chazy at Sloop Bay on Valcour Island, N. Y.

Family LEDIDÆ Adams.

Genus **Clidophorus** Hall.

4. **Clidophorus obscurus** Raymond. (Plate XXIX, figure 9).

*Clidophorus obscurus* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 372.

*Description.*

Shell small, longer than high, not very convex. Basal margin nearly straight, anterior end rounded, posterior end narrow. In front of the beak the cast shows a short clavicular impression which extends about half the distance to the lower margin. The single specimen is 6 mm. long and 4 mm. high.

*Locality.*—Trilobite layers, Middle Chazy, Sloop Bay, Valcour Island, N. Y.

Family CYRTODONTIDÆ Ulrich.

Genus **Cyrtodonta** Billings.

5. **Cyrtodonta solitaria** Raymond. (Plate XXIX, figure 15).

*Cyrtodonta solitaria* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 373.

Only a single right valve of this species has been found. It is roughly triangular, the beak a little behind the anterior end, and the hinge line short. The anterior end is narrow and rounded, the basal margin long and straight, making an angle of about  $45^{\circ}$  with the hinge. Posterior margin regularly rounded. Shell only moderately convex, the slope to the posterior margin gradual and that to the front nearly flat. Surface marked by concentric lines of growth. The length is 15 mm. and height 12.5 mm. This is a larger, more compressed and smoother shell than *C. lamellosa*, Hudson.

*Locality*.—From the Lower Chazy at the ledge in the pasture at Tracy Brook, Chazy, New York.

6. **Cyrtodonta lamellosa** Hudson. (Plate XXIX, figure 16.)

*Cyrtodonta? lamellosa* HUDSON, Report of the New York State Paleontologist for 1903 (1904), p. 287, Pl. 4, figs. 10-13.

This is a small shell with moderately convex valves, and very strong lamellæ of growth. For a detailed description, Professor Hudson's paper should be consulted.

7. **Cyrtodonta scala** Raymond. (Plate XXIX, figure 14.)

*Cyrtodonta scala* RAYMOND, Annals Carnegie Museum, Vol. III, 1906, p. 578.

Shell small, strongly convex, the anterior lobe small and depressed. Posterior margin semicircular in outline. Slope from the umbo to the posterior margin more gentle than that to the anterior. One specimen is 11 mm. long and 9 mm. high.

*Locality*.—This species has been found only in the trilobite layers at Sloop Bay, Valcour Island, where it is rare.

Genus **Vanuxemia** Billings.

8. **Vanuxemia limbata** Raymond. (Plate XXIX, figures 10, 11.)

*Ctenodonta limbata* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 371.

Outline nearly circular, the beak terminal, the shell strongly convex and rounded. Greatest convexity near the middle of the valve; all slopes steep. The cast shows a few faint lines of growth.

The largest specimen is 10 mm. long and 10 mm. high. A smaller one is 8 mm. in either dimension.

*Locality*.—All the specimens are from the trilobite layers at Sloop Bay, Valcour Island, New York.

## Family AMBONYCHIDÆ Miller.

Genus **Clionychia** Ulrich.9. **Clionychia montrealensis** (Billings). (Plate XXIX, figures 18-24.)

*Vanuxemia montrealensis* BILLINGS, Canadian Naturalist and Geologist, Vol. IV, 1859, p. 447, figs. 25, 26; Geology of Canada, 1863, p. 131, figs. 61a, 61b.

*Clionychia montrealensis* WHITEAVES, Ottawa Naturalist, Vol. XXII, 1908, p. 107.

*Description.*

Shell of medium size, sub-triangular in outline, beaks terminal and directed forward. Umbones narrow and depressed. The greatest convexity of the shell is along the middle of the valve. The anterior slope is somewhat more abrupt than the posterior, and the posterior side is drawn out into a short wing. The posterior margin is gently convex, and makes an angle of about  $100^{\circ}$  with the hinge. The basal margin is nearly semicircular, and the anterior margin straight or slightly concave.

One specimen is 12 mm. long and 14 mm. high, and another 13.5 mm. long and 15 mm. high.

*Locality.*—This is one of the commoner species in the middle and Upper Chazy at Valcour Island and Chazy, New York, and Montreal, Canada. The types are a small right valve and a larger left valve on a small piece of limestone from Montreal.

10. **Clionychia marginalis** Raymond. (Plate XXIX, figures 25, 26.)

*Clionychia marginalis* RAYMOND, American Journal of Science, (Ser. 4), Vol. XX, 1905, p. 373.

Most specimens of this species are larger than those of *C. montrealensis*, and can readily be distinguished from that species by the almost perpendicular front slope, the shorter hinge line and the less oblique axis of the shell.

*Description.*

Both valves moderately convex, the umbones somewhat depressed, but increasing rapidly in height, the greatest thickness of the valves being at about one-third the distance from the beak to the lower margin. Hinge line short. The posterior margin is broadly rounded, the lower margin semicircular. The front is almost straight. The greatest convexity is along a line parallel to the front. The posterior

and lower slopes are gentle, but the front slope is abrupt, making an angle of almost  $90^{\circ}$  with the plane of union of the valves. The surface is marked by very fine concentric lines of growth.

One specimen is 20 mm. long and 26.5 mm. high.

*Locality*.—This species is found in the Lower Chazy at Chazy and Valcour Island, New York.

### Genus *Ambonychia* Hall.

II. *Ambonychia curvata* Raymond. (Plate XXIX, figures 27, 28; Plate XXX, figures 1-3.)

*Ambonychia? curvata* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 373.

One of the most common pelecypods in the Chazy is a large form which appears to belong to the genus *Ambonychia*, but as all the specimens so far found are internal casts, there is no evidence as to whether or not it had the characteristic radial striae of that genus.

### *Description.*

Shell large, both valves very strongly convex, especially along the region at the front and middle of the valves. Beaks small, incurved, directed a little forward. Anterior slope abrupt and overhanging. Posterior and basal slopes rather steep. Posterior wing short. The posterior margin is slightly convex, almost straight, the anterior margin rounded.

The length and height are nearly equal. A large specimen is 27 mm. long and 26 mm. high. Another is 43 mm. long and 39 mm. high. A small one is 10 mm. long and has the same height. The species is easily recognized by the curved anterior margin and great convexity. It is possible to confuse *Clionychia montrealensis*, *C. marginalis*, and *Ambonychia curvata*, but *C. montrealensis* has the greatest convexity along the middle of the valve; in *C. marginalis* it is along the anterior margin, and in *Ambonychia curvata* the line of greatest convexity is along a curve the convex side of which is forward. *Clionychia montrealensis* also has much more narrow and depressed beaks than the other two species.

*Locality*.—All through the Chazy, especially in the upper part, at Chazy, Valcour Island, and Sloop Island, New York.



## Family CONOCARDIIDÆ Neumayr.

Genus *Conocardium* Brongniart.12. *Conocardium beecheri* Raymond. (Plate XXX, figures 4-10.)

*Conocardium beecheri* RAYMOND. American Journal of Science (Ser. 4), Vol. XX, 1905, p. 374.

One of the unexpected discoveries made while collecting at Valcour Island was a small *Conocardium* which was found in great numbers on Sloop Island, a rock about one-fourth mile east of Valcour Island. The writer has since found it on the main island of Valcour, and at Chazy but it is very rare at both these places. Twenhofel and Schuchert recently found it on the Mingan Islands.<sup>21</sup>

*Conocardium beecheri* is the oldest representative of the genus. *Conocardium immaturum* Billings, from the Black River at Pauquette's Rapids on the Ottawa River, is of about the same size as our specimens, but differs from them in having a broader and shorter anterior wing, and a smooth posterior wing. The only other Ordovician species is *Conocardium (Pleurorhynchus) antiqua* Owen, from the Ordovician at Lower Fort Garry, on the Red River of the North. This species is not well known, as no description has been published, and only a single imperfect specimen figured.

*Eopteria typica* and *Euchasma blumenbachia*, both described by Billings, have somewhat the form of *Conocardium*, but a different hinge-structure. They are not well known. Dall, in the American edition of Zittel's Paleontology, places these genera with doubt in the family *Cardiolidæ*. They are believed by others to be Crustacea.

*Description.*

Shell small but robust, with long anterior and short posterior wings. The region of greatest convexity is along the mid-line of the shell, the convexity decreasing gradually to the anterior wing and rather abruptly to the posterior one. The anterior wing is long, with a straight lower margin. The posterior wing is short and narrow, joining the shell at a large angle. The surface is marked by seven or eight large plications on the anterior wing, fifteen to twenty smaller ones on the body of the shell, and three or four very large ones on the posterior wing.

<sup>21</sup> Bull. Geol. Soc. America, Vol. 21, p. 692, 1910.

One specimen is 6.5 mm. long and 5 mm. high, while a second is 6 mm. long and 4 mm. high.

*Locality*.—Found at the base of the Upper Chazy on Sloop Island, east of Valcour Island, N. Y. Also at the same horizon on Valcour Island and at Chazy, New York. Also in the Upper Chazy at the Mingan Islands, Canada.

Family MODIOLOPSIDÆ Fischer.

Genus **Whiteavsia** Ulrich.

13. **Whiteavsia? undata** Raymond. (Plate XXX, figures 23, 24.)

*Whiteavsia? undata* RAYMOND, Annals Carnegie Museum, Vol. III, 1906, p. 578.

Shell rather small, robust, the upper and lower margins sub-parallel. Beak elevated, incurved, small. A broad, shallow depression extends from the umbo to the basal margin, giving the shell a flattened appearance. Anterior margin nearly straight, meeting the hinge in almost a right angle. Posterior margin rounded. From the umbo an oblique ridge extends to the lower anterior angle of the shell, and the slope from this ridge to the front is steep.

The length is 25 mm. and the height 12.5 mm.

*Locality*.—A very rare shell in the trilobite layers, Sloop Bay, Valcour Island, New York.

14. **Whiteavsia ? expansa** Raymond. (Plate XXX, figure 20.)

*Whiteavsia? expansa* RAYMOND, Annals Carnegie Museum, Vol. III, 1906, p. 578.

Shell oval in outline, only moderately convex, with a strong ridge running diagonally from the beak to the lower posterior angle. The slope from this ridge to the hinge and posterior margin is abrupt and rounded. To the basal margin the slope is gradual and almost flat. The internal cast shows a small but distinct anterior muscle scar and strong concentric growth lines, which are especially prominent on the umbonal portion of the shell.

An average specimen is 14 mm. high and 19 mm. long.

*Locality*.—A rare species in the trilobite layers of the Middle Chazy at Valcour Island, New York.

Genus **Endodesma**.

15. **Endodesma tranceps** Raymond. (Plate XXX, figures 17-19.)

*Cyrtodonta tranceps* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 372.

This is one of the commoner species of the Middle Chazy. All the specimens are casts of the exterior. The change in generic reference is due to Mr. Ulrich, who has seen some of the typical specimens.

*Description.*

Shell roughly rectangular in outline, strongly convex at the umbo and along a ridge which runs diagonally across the shell to the lower posterior angle. In front of this ridge there is usually a slight depression running from the umbo to the middle of the lower margin. The posterior margin is regularly rounded, and the basal margin straight or slightly concave. The anterior end extends a short distance in front of the beak. The slope to the hinge is flat and rather steep. The slope to the front and base is gently convex and more gradual than that to the hinge. The surface is marked by fine concentric lines.

*Locality.*—Rather common in the middle Chazy at Valcour Island, New York.

Genus **Modiolopsis** Hall.

16. **Modiolopsis fabaformis** Raymond. (Plate XXX, figures 12, 13.)  
*Modiolopsis fabaformis* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 374.

This little shell, which much resembles the *Modiolopsis faba* of the Trenton, is the one pelecypod which is common in the upper layers of the Chazy at Valcour Island. In the upper one hundred feet of the section at that point it is quite abundant in connection with *Camarotoechia plena*. It is related only to *Modiolopsis exanimis* of the Chazy species of the genus.

*Description.*

Shell small, narrow, thick, with a strong ridge extending from the umbo to the lower posterior angle. In front of this ridge is a deep depression which continues to the middle of the ventral margin, making that margin sinuate. The anterior ear is small and convex; anterior margin narrowly rounded. Posterior margin broadly rounded, not oblique as in *Modiolopsis parviuscula*. The surface is marked by numerous lines of growth. This is not the *Modiolopsis fabaformis* of Whiteaves,<sup>22</sup> which is a shorter and higher shell.

*Locality.*—Common in the Upper Chazy on Valcour Island, New York.

<sup>22</sup> Ottawa Naturalist, Vol. XXII, 1908, p. 110, pl. III, figs. 7-9.

17. *Modiolopsis exanimis* sp. nov. (Plate XXX, figure 11.)

This species is very like the preceding, but is so much shorter and higher that it cannot be united with it.

*Locality*.—A rare species in the Upper Chazy on Valcour Island, New York.

18. *Modiolopsis parviuscula* Billings. (Plate XXX, figures 14, ? 15, 16.)

*Modiolopsis parviuscula* BILLINGS, Canadian Naturalist and Geologist, Vol. IV, 1859, p. 446; WHITEAVES, Ottawa Naturalist, Vol. XXII, 1908, p. 106, pl. III, figs. 1, ? 2.

This species which was described by Billings in a single sentence of less than two lines, and not figured, must rest on the single Chazy specimen now remaining at Ottawa. This specimen is on a bit of fine-grained, dirty-looking limestone from Cornwall, Ontario, and in the same bit of matrix there are several fragments of *Camarotoechia plena*. The *Modiolopsis* is apparently crushed and flattened, and shows nothing more than the general outline. The distinctive feature about the specimen is that the posterior basal angle projects beyond the upper angle or any part of the posterior end of the shell. In this feature the shell is like *Modiolopsis modiolaris*, to which Billings compared it, and by the same feature it may be distinguished from all other species of *Modiolopsis* in the Chazy or Aylmer formations.

*Description.*

The type, a right valve, is small, with short hinge and semicircular anterior end. The ventral margin is nearly straight, and much longer than the hinge. The posterior margin is oblique, the posterior angle abruptly rounded, while the posterior dorsal angle is very obtuse. A low broad ridge extends from the umbo to the lower posterior angle, and the shell slopes gently in all directions from it. The surface is marked by numerous concentric lines of growth.

*Locality*.—From the Upper Chazy at Cornwall, Ontario.

What appears to be the same species occurs in the lower part of the Pamela formation at Aylmer, and a very good specimen, collected by T. W. E. Sowter at that locality, is figured (Pl. XXX, figs. 15, 16).

19. *Modiolopsis subquadrilateralis* Hudson.

*Modiolopsis subquadrilateralis* HUDSON, Report of the N. Y. State Paleontologist for 1903 (1904), p. 286, Pl. 4, figs. 8, 9.

This is a small shell, with smooth, convex valves. It is described in detail in Professor Hudson's recent paper.

20. *Modiolopsis sowteri* Raymond. (Plate XXX, figures 21, 22.)

*Modiolopsis sowteri* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 374.

One of the most common and best preserved pelecypods occurring in the Aylmer formation is a species of *Modiolopsis* to which I gave the specific name, *sowteri*, in honor of T. W. E. Sowter, Esq., of Aylmer, Quebec, who has given much close attention to the study of the Aylmer formation, and who collected a large part of the many new species which have been described from his native town.

*Description.*

Shell of medium size for the genus, rather convex, with a strong ridge running from the beak to the lower posterior angle. Toward the front is a slight depression, running from just ahead of the beaks a little backward to the basal margin. In front of the beak is a very deeply impressed anterior muscle scar, which on the internal cast, is represented by a rounded, conical elevation. The posterior scar is large, and close to the hinge line. One specimen is 51 mm. long and 28 mm. high; another 33 mm. long and 20 mm. high.

*Locality.*—From the Aylmer sandstone (Upper Chazy), about sixty feet above the high water mark of Lake Deschenes, at Aylmer, Quebec. Collected by T. W. E. Sowter.

## APPENDIX.

The following species were described as coming from the Chazy, but really belong to the overlying formation, the Pamelia, which is of Lower Black River age.

21. *Ctenodonta parvidens* Raymond. (Plate XXIX, figures 7, 8.)

*Ctenodonta parvidens* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 373; WHITEAVES, Ottawa Naturalist, Vol. XXII, 1908, p. 113, pl. 3, fig. 16.

One of the commonest species in the shale and sandstone of the



Pamelia formation at the Hogs Back, near Ottawa, is a *Ctenodonta*, which is much larger than *C. peracuta*, and which differs from *C. dubiaformis* in not having the beaks centrally located. There are some points in which the shell agrees with *C. nasuta* (Hall), but the shape of the posterior end is different, and the teeth are smaller and more numerous.

*Description.*

Shell oval in outline, usually flattened, but specimens from the harder layers show a considerable convexity below the umbo, with regular slopes to the anterior, posterior, and ventral margins. The anterior and posterior margins are regularly rounded, and the posterior end is a little narrower than the anterior. The cast shows the impressions of numerous very fine teeth on the hinges, but the number cannot be counted, as the beak is always flattened down upon the hinge. One specimen shows five teeth on the posterior side of the beak and another shows seven. The surface is marked by numerous concentric lines of growth.

*Locality.*—In the shale and sandstone of the Pamelia formation at the Hogs Back, near Ottawa, Ontario.

**22. *Cyrtodonta breviscula* Billings.** (Plate XXIX, figure 17.)

*Cyrtodonta breviscula* BILLINGS, Canadian Naturalist and Geologist, Vol. IV, 1859, p. 446; WHITEAVES, Ottawa Naturalist, Vol. XXII, 1908, p. 107, Pl. 3, fig. 3.

The type of the species is a small left valve in a bit of almost pure quartz sandstone. The type has been unique until recently, when the writer rediscovered the original locality "three miles east of Ottawa," on a road leading toward the river just beyond Robillard's quarries.

*Description.*

Shell small, nearly as high as long. Hinge short, straight. Beak near the anterior end of the shell, overhanging the hinge margin. Anterior lobe small, semicircular. Basal margin straight, posterior margin gently curved, oblique. Valves rather thick, the highest point a little back of the umbo. A strongly elevated ridge extends from the umbo to the posterior ventral angle. The type is 12.5 mm. long and 10 mm. high. A larger specimen is 20 mm. long and 15 mm. high.

*Locality.*—The type-locality is just below the quarry in the Pamelia

limestone on the road running from Montreal Road to the Ottawa River, three miles east of Ottawa, where there is an outcrop of white sandstone by the roadside. The species also occurs in the limestone of the Pamela all around Ottawa.

23. **Sowteria canadensis** (Raymond). (Plate XXIX, figures 12, 13).

*Whitella canadensis* RAYMOND, American Journal of Science (Ser. 4), Vol. XX, 1905, p. 373.

*Sowteria canadensis* WHITEAVES, Ottawa Naturalist, Vol. XXII, 1908, p. 112, Pl. 3, figs. 13-15.

Whiteaves's description of the genus is as follows:

Shell rather small, equivalve, moderate'y convex, sometimes tumid and always most prominent on the oblique posterior umbonal slope; subtrapezoidal in marginal outline, a little longer than high, and very inequilateral. Posterior area defined by an abrupt inflection of each valve at and behind the subangular umbonal declivity.

"Test unknown; in casts of the interior the greater part of the surface is marked by a few large concentric rib-like folds, but the posterior area of both valves is nearly or quite smooth. Hinge dentition and muscular impressions unknown."

*Specific Characters.*

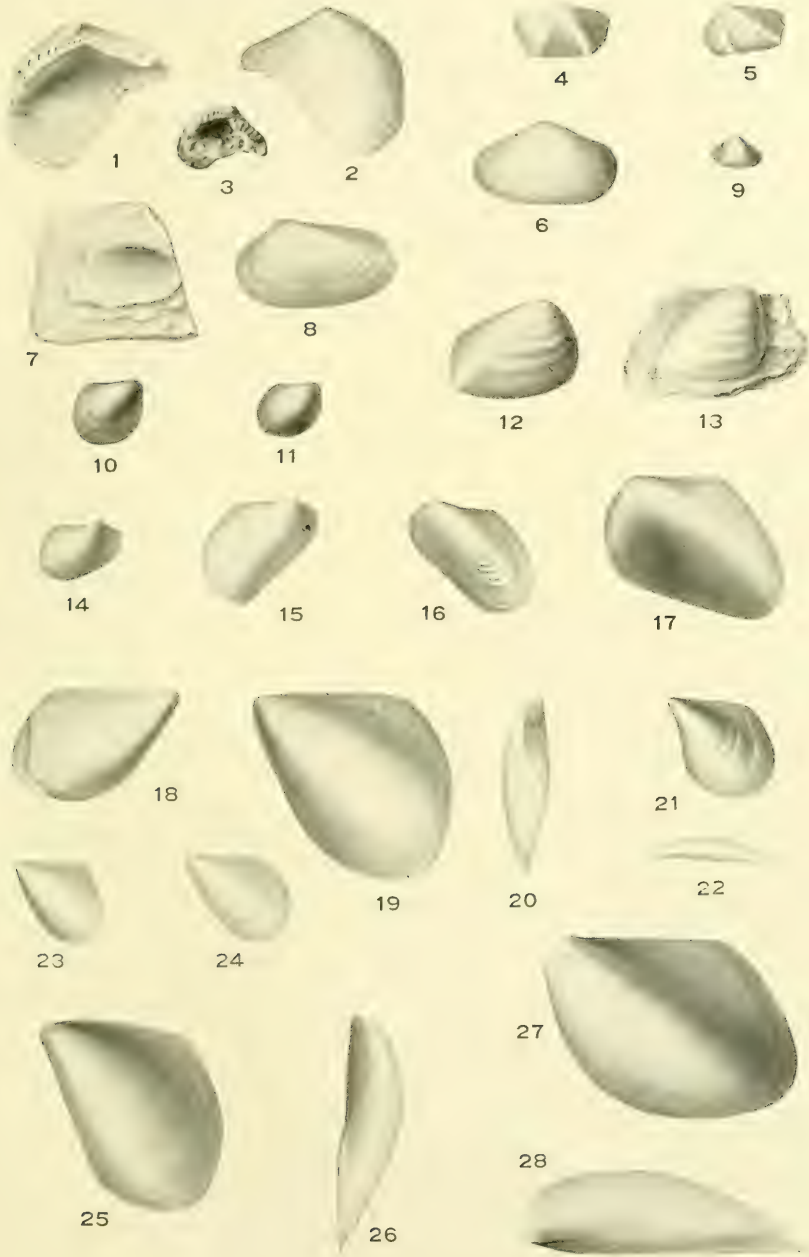
"Anterior portion of each valve very short, in some specimens truncated almost vertically at its extremity, in others faintly concave under the beaks above, and rounded at or below the mid-height; posterior portion moderately its extremity obliquely subtruncate above and narrowly rounded below. Superior border and ventral margin nearly straight or very gently convex; beaks nearly or quite terminal."

*Locality.*—Rather common in the sandstone of the Pamela at Aylmer, near Wright's brickyard above Tetreauville, and at the same locality east of Ottawa as *Cyrtodonta breviscula*.

EXPLANATION OF PLATES.

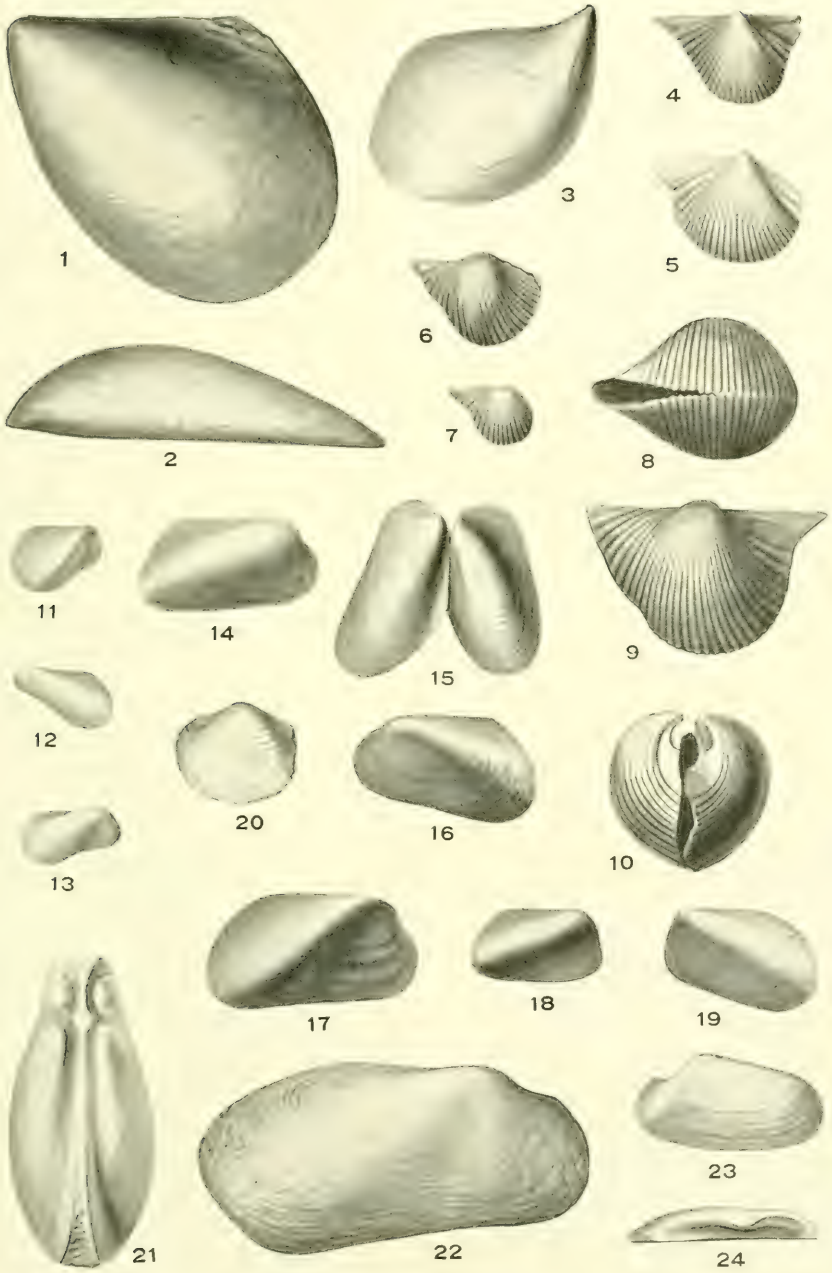
PLATE XXIX.

1. *Ctenodonta peracuta* Raymond. A small, imperfect, but free, right valve,  $\times 4$ .
2. The same specimen, exterior view,  $\times 4$ .
3. The same specimen, a photograph of the interior.
- 4, 5. *Ctenodonta ? bidorsata* Raymond. Two specimens. Natural size.



Pelecypoda of the Chazy.





Pelecypoda of the Chazy.





6. *Clenodonta dubiaformis* Raymond. Natural size.
- 7, 8. *Clenodonta parvidens* Raymond. The interior of one specimen and exterior of another. Natural size.
9. *Clidophorus obscurus* Raymond. The type, natural size.
- 10, 11. *Vanuxemia limbata* Raymond. Two right valves, natural size.
- 12, 13. *Sowteria canadensis* (Raymond). Two right valves, natural size.
14. *Cyrtodonta scala* Raymond. A right valve, natural size.
15. *Cyrtodonta solitaria* Raymond. The only known specimen, natural size.
16. *Cyrtodonta lamellosa* Hudson. The left valve of a complete individual.  $\times 2$ .
17. *Cyrtodonta breviscula* Billings. The type.  $\times 2$ .
- 18, 19, 20. *Clionychia montrealensis* (Billings). The types, natural size.
- 21, 22, 23, 24. The same species. Specimens from Valcour Island, natural size.
- 25, 26. *Clionychia marginalis* Raymond. The holotype, natural size.
- 27, 28. *Ambonychia ? curvata* Raymond. A left valve, natural size.

## PLATE XXX.

- 1, 2, 3. *Ambonychia ? curvata* Raymond. The cotypes, natural size.
- 4, 5. *Conocardium beecheri* Raymond. A left and a right valve.  $\times 4$ .
- 6, 7. The same species. Two left valves.  $\times 2$ .
- 8, 9, 10. The same species. A specimen retaining both valves.  $\times 6$ .
11. *Modiolopsis exanimis* Raymond. A right valve, natural size.
- 12, 13. *Modiolopsis fabaformis* Raymond. A left and a right valve, natural size.
14. *Modiolopsis parviuscula* Billings. The type, natural size.
- 15, 16. ?*Modiolopsis parviuscula*, Billings. A specimen supposed to be this species, natural size.
- 17, 18, 19. *Endodesma transceps* Raymond. Two right valves and one left valve, natural size.
20. *Whiteavesia ? expansa* Raymond. An imperfect left valve, natural size.
- 21, 22. *Modiolopsis sowteri* Raymond. An internal cast, and a cast of the exterior of a right valve, natural size.
- 23, 24. *Whiteavesia ? undata* Raymond. A left valve, natural size.

## XV. SOUTH AMERICAN CRICKETS, GRYLLOTALPOIDEA, AND ACHETOIDEA.

BY LAWRENCE BRUNER.

As in the case of my four former papers on the Orthoptera of Brazil and surrounding portions of South America, published in these ANNALS, the present paper is based upon material belonging to the Carnegie Museum. The collections as a whole are rather rich in forms, and permit of a fairly comprehensive treatment of the South American orthopteran fauna. The present paper contains descriptions of a number of apparently new forms. While not presenting a complete synopsis of the crickets of South America, I have included a number of synoptical tables for the separation of families, genera, and in some instances of species as well.

There has been a tendency among systematic entomologists during the past few years to consider the orthopteroid insects as being of more than ordinal value. The present writer, as a result of a study of the group, shares this opinion. In a recent paper<sup>1</sup> he has given his views in a synoptical key or table compiled from several sources. This table is presented herewith and shows the relationships of the several groups of insects which he would include under the term "orthopteroid insects."

### SYNOPSIS OF THE ORDERS AND SUBORDERS OF ORTHOPTEROID INSECTS.

A. Tarsi normally five-jointed.

b. Cerci distinctly segmented or jointed.

c. Apterous, structure thysanuran. Eyes small, with few facets. Ovipositor of female exserted. Terrestrial, subterranean, dwellers among rocks in darkness [Alberta, Canada] . . . . . Order GRYLLOBLATTARIA.

cc. Normally winged, but frequently with those organs subobsolete or entirely missing. Structure not thysanuran. Ovipositor of female not exserted.

d. Eggs contained in a capsule, or oötheca, sometimes carried by the female. Insects not social. Species represented only by males and females.

<sup>1</sup> A Preliminary Catalogue of the Orthopteroid Insects of the Philippine Islands (University Studies, Vol. XV, No. 2, pp. 195-281, Lincoln, Neb., 1915.)

*c.* Body oval, depressed, much broader than deep at the posterior extremity of the prothorax. Head nearly horizontal and wholly, or almost wholly, concealed beneath the pronotum, the mouth posterior, or infero-posterior, when at rest; ocelli generally two in number. Pronotum clypeate, usually transverse. Legs depressed, rather lengthily and numerous spined. Insects of rapid movements. Oötheca chitinized, usually carried by parent.....Order DICTYOPTERA, or BLATTARIA.

*ee.* Body elongate, generally narrow, even when depressed or expanded but little broader than deep at the posterior extremity of the prothorax. Head free, often separated from the prothorax by a deep constriction; ocelli three or wanting. Pronotum never transverse, except occasionally by laminate expansions. Legs rarely depressed, the front pair constructed for grasping. Insects of deliberate movements. Oötheca membranous, not carried by parent, but attached to twigs, bark, or other objects.....Order MANTARIA.

*dd.* Eggs not contained in a capsule or oötheca. Insects social. Frequently constructing large and complicated nests. Species represented by males, females, workers, and warriors.

Order ISOPTERA.

*bb.* Cerci not segmented or jointed. Body normally elongate, narrow. Head subhorizontal, generally quadrate or gibbous; mouth antero-inferior; ocelli often wanting; antennæ usually longer than the body and coarse. Pronotum very short. Legs all constructed for walking. Eggs dropped singly and indiscriminately.....Order GRESSORIA.

*AA.* Tarsi normally four- or three-jointed, very rarely two-jointed. Stridulating organs and auditory apparatus often present.

*b.* Posterior legs constructed for jumping, much more robust and longer than the others. Organs of flight in a reversed position when immature. Head vertical, ovipositor with a few exceptions free or exerted.

Order SALTATORIA.

*c.* Antennæ generally much shorter than the body, filiform, clubbed or ensiform, the joints distinct, often depressed. Ocelli two or three. Tarsi three-jointed.

*d.* Anterior legs constructed for walking or clinging to vegetation, not fitted for burrowing. Tarsi similar in structure on all the legs. Stridulating organs located on the hind femora and costal field of front wings. Auditory apparatus situated on the sides of the basal abdominal segment. Ovipositor composed of four horny plates divergent at tip.....Suborder LOCUSTOIDEA.

*dd.* Anterior legs greatly modified for burrowing in the earth. Tarsi of the front pair of legs differing from those of the other pairs. Stridulating organs located on the tegmina or front wings. Auditory apparatus, when present, confined to the anterior tibiæ. Ovipositor not exerted. Body of insect cylindrical. Antennæ variable, but not typically setaceous, as in the two following suborders.....Suborder GYRLLOTALPOIDEA.

cc. Antennæ much longer than the body, setaceous, delicately tapering. Stridulating organs, when present, situated on the anal field of the tegmina. Auditory apparatus situated near the base of the front tibiæ. Ovipositor usually prolonged into a compressed blade or needle, its parts compact.

d. Ocelli variable. Tarsi three-jointed, those of the front legs or else of the hind legs differing from the others in structure. The middle field of the tegmina in repose, like the anal field, nearly or quite horizontal; male tegmina (when present) furnished on the dorsal surface with a tympanum (very rarely absent) extending across both the anal and median areas, crossed by a prominent nervure formed by the main anal vein, and as a whole broader than the rest of the tegmen. Ovipositor (unless, as rarely, concealed) forming a nearly cylindrical straight or occasionally upcurved needle, the inner valves generally scarcely exposed except at the expanded tip. .Suborder ACHETOIDEA.

dd. Ocelli generally wanting. Tarsi nearly always four-jointed, very similar in structure on all the legs. Middle field of tegmina in repose, like the costal field, nearly or quite vertical; base of the male tegmina (when present) furnished on the dorsal surface with a tympanum limited to the anal area, crossed by a prominent nervure formed by the last branch of the anal vein, and as a whole narrower than the rest of the tegmen. Ovipositor (unless, as rarely, concealed) forming a strongly compressed, generally ensiform blade, the inner valves almost always partially exposed the entire length of the ovipositor, the tip not expanded.

Suborder TETTIGONOIDEA.

bb. Posterior legs similar to the others, not constructed for jumping. Tarsi three-jointed. Organs of flight (when present) in a normal position. Ovipositor concealed by the subgenital plate. . . . Order DERMAPTERA.

c. Always apterous. Parasitic on mammals.

d. Eyes much reduced. Mandibles strongly flattened, not adapted to mastication, but the inner margin densely clothed with bristles. Cerci feebly chitinized, forming incipient forceps. Maxilla with the inner lobe furnished with two apical teeth (Malayan Archipelago). . . . Suborder ARIXENIA.

dd. Eyes absent. Mandibles normal. Cerci non-segmented, feebly chitinized, not horny. Inner lobe of maxilla with four apical teeth. Viviparous. (African). . . . Suborder HEMIMERINA.

cc. Fully winged or apterous. The wings, when present, four in number, the anterior pair corneous, the hind pair membranous, complicatedly folded and tucked beneath the former. Not parasitic. Cerci modified into strongly chitinized horny forceps. Inner lobe of the maxilla provided with four apical teeth. Oviparous. . . Suborder FORFICULINA.

KEY FOR SEPARATING THE SOUTH AMERICAN FAMILIES OF ACHETOIDEA.

A. Tarsi compressed, the second joint minute.

b. Posterior tibiæ moderately robust.



- c. Posterior tibiæ biserially spinose.
  - d. The hind tibiæ armed with spines on both sides, the carinæ not at all serrated.
    - e. Hind tibiæ armed with long, movable, hairy spines. The posterior metatarsi unarmed above, or provided with but a single row of serrulations. . . . . *Nemobiidæ*.
  - ee. Hind tibiæ armed with heavy fixed spines, or in some instances spines partly movable. Head globose, or very gently depressed; the face vertical. The front between the antennæ neither swollen nor produced. The superior or upper claw of the hind tibiæ shorter than the middle one, or of equal length. Ocelli disposed in a triangle. Hind femora shorter than the combined length of the tibiæ and tarsi. . . . . *Achetidæ*.
  - dd. Posterior tibiæ on both sides of the basal portion serrated, of the apical portion spined. Tegmina either abbreviated or wanting.
    - Gryllomorphenidæ*.
- cc. Posterior tibiæ usually biserially serrulate. Without spines on their lateral margins, but sometimes having them present in their middle towards the apex.
  - d. Body subspherical, apterous. Antennæ heavy, subfiliform. Hind femora enormous, dilated, oval. Eyes subobsolete, minute. Anterior tibiæ without auditory apparatus. Hind tibiæ without serration and provided above near their middle with several movable spines; apex with only three or four claws. . . . *Myrmecophilidæ*.
  - dd. Body subelongate. Antennæ slender, setaceous. Eyes distinct. Posterior femora more slender, clavate; hind tibiæ slender, provided at apex with six claws. Body covered with scales. In the females apterous, in the males provided with membranous tegmina. Anterior tibiæ sometimes provided with auditory apparatus. Hind tibiæ serrulate, not spinose, provided with elongate claws.
    - Mogoplistidæ*.
- bb. Posterior tibiæ slender, armed on the lateral edges with slender spines, between which the canthi are serrulate. Male tegmina with the speculum divided by one, two, or more, veins.
  - c. Apex of the posterior tibiæ provided with five claws; on the inside two, on the outside three. . . . . *Pentacentridæ*.
  - cc. Apex of the posterior tibiæ provided with six claws; three inside, three outside.
    - d. Head vertical, vertex short, mouth inferior or below. All the tibiæ armed with movable spurs. The male speculum of the tegmina (when developed) divided by two veins. . . . . *Phalangopsitidæ*.
    - dd. Head elongate, horizontal, mouth directed to the front. Pronotum slender, longer than wide, the lateral lobes narrowed anteriorly. Anterior and middle tibiæ without spurs. The speculum of the male tegmina divided by a single vein. . . . . *Æcanthidæ*.
- AA. Tarsi with the second joint depressed, heart-shaped.
  - b. Posterior tibiæ not serrated, biserially spinose, and provided on each side

with three movable spines; the apex sometimes furnished with two claws on the inner side. Female ovipositor short and curved; speculum of the tympanum of the male tegmina undivided. Size of insects small.

*Trigonidiidæ.*

*bb.* Posterior tibiæ usually, but not always, serrated, also spined on both sides, the apex furnished with three spurs on each side. Ovipositor straight or a very little curved; speculum of the tympanum of the male tegmina divided by one (or sometimes two) veins. Size of insects medium to large.

*c.* Claws of the posterior tibiæ elongate, the intermediate one on each side much longer than the upper. Metatarsi elongate. Pronotum anteriorly coarctate, the angles somewhat acute, lateral lobes oblique, in front angulate. Head robust or large, eyes prominent at sides; tegmina of moderate size and of the usual form, the lateral field bent down at right angle; in the males with the tympanum provided with two oblique parallel veins. Apex of the ovipositor furnished with lanceolate, acute, non-dentate valves.....*Eneopteridæ.*

*cc.* Claws of the posterior tibiæ minute on the outer side, on the inner side rather long, the upper one longest and the lower one shortest. Metatarsi usually short, sparsely dentate basally. Ovipositor variable, cylindrical, apical valves dentate, or flattened.

*d.* Posterior tibiæ not at all serrulate, but armed on both edges with two sizes of spines. Insects large, their body and legs robust. Ovipositor heavy, its apical valves depressed and with its tip truncated.....*Stenogryllidæ.*

*dd.* Posterior tibiæ both serrulate and spined. Insects variable in size, the body generally rather slender, with the legs variable. Ovipositor graceful, the apical valves not flattened, acuminate, or blunt, the margins dentate or crenulate.....*Podoscirtidæ.*

#### KEY FOR SEPARATING THE FAMILIES OF THE SUBORDER GRYLLOTTALPOIDEA.

*A.* Anterior tibiæ greatly dilated and digitate. Antennæ filiform, many-jointed. Head without, or provided with but two, large ocelli.

*b.* Antennæ setaceous, rather long. Elytra or tegmina membranous, in the male provided with a tympanum or stridulating surface. Pronotum elongate-oval. Tarsi three-jointed. Posterior legs small, saltatorial, the tibiæ somewhat dilated. Cerci long and setaceous.....*Curtillidæ.*

*bb.* Antennæ very short. Body linear, cylindrical. Elytra or tegmina almost absent. Posterior legs very short, non-saltatorial. Tarsi two-jointed. Cerci not apparent. Ocelli absent and the eyes small, ocelliform.

*Cylindrodidæ.*

*AA.* Anterior tibiæ little dilated, three- to four-spined at apex. Antennæ short, moniliiform, composed of few joints. Posterior legs strongly saltatorial, the femora dilated; tibiæ slender, four-clawed at apex, tarsi single-jointed or aborted. Elytra corneous, without a tympanum. Head furnished with three ocelli.....*Tridactylidæ.*

## SYNOPSIS OF THE SOUTH AMERICAN GENERA OF CURTILLIDÆ.

- A. Anterior tibiæ four-toed.
  - b. Posterior tibiæ provided with several spines on inner margin. [Old world and west coast of America.].....*Curtilla*.
  - bb. Posterior tibiæ without spines on inner margin, or seldom with a single small spine. [New world, except west coast].....*Neocurtilla*.
- AA. Anterior tibiæ two-toed. [New World].....*Scapteriscus*.

## Genus CURTILLA Oken.

*Curtilla* OKEN, Lehrb. Nat., III, (1815), p. 445.

*Acheta* LINNÆUS (in part) Syst. Nat. (ed. X), I, (1758), p. 428.

*Gryllotalpa* LATREILLE, Hist. Nat. Crust. Ins., III, (1802), p. 275, and many others, until very recently.

The representatives of this genus of mole-crickets occur chiefly in the Orient. At least two species, however, are native to the American hemisphere, where they are confined to the region of the western coast. A third species, the oldest known, has been introduced by commerce to our cities on the eastern coast and possibly also to the principal South American seaports. The following key will aid in separating these three forms:

## SYNOPSIS OF AMERICAN SPECIES OF CURTILLA.

- A. Size large, 40 to 45 mm. in length. [Various sea-ports, introduced from Europe.].....*gryllotalpa* Linnæus.
- AA. Smaller, 26 to 35 mm. in length.
  - b. Pronotum provided with a median fulvous line. Size 26-28 mm. [Chile] *chilensis* Saussure.
  - bb. Pronotum without a median fulvous line. Size 30-34 mm. [California, Mexico, and possibly to Isthmus of Panama].....*cultriger* Uhler.

I. *Curtilla cultriger* (Uhler).

*Gryllotalpa cultriger* UHLER, Proc. Ent. Soc. Philad., II (1864), p. 343; Scudder, Mem. Peabody Acad. Sci., I (1869), p. 23, Pl. I, figs. 13, 32, 33, etc.

*Curtilla cultriger* KIRBY, Syn. Cat. Orth., II (1906), p. 6.

A single female specimen of this insect is at hand bearing the label "Fuerte, Sinaloa, Mexico, Mrs. Bissell." This specimen belongs to the Holland Collection in the Carnegie Museum.

## SYNOPSIS OF SOUTH AMERICAN SPECIES OF NEOCURTILLA.

- A. Process of the anterior trochanters large, more or less distinctly triangular in form.
  - b. Apex of the hind tibiæ armed with only four spines. Tegmina and wings well-developed.....*macilenta* Saussure.
  - bb. Apex of the hind tibiæ armed with six spines, three on each side. Tegmina very short, wings absent.....*minor* sp. n.

AA. Process of the anterior trochanters rather small, rounded.

b. Wings elongate, passing, or about reaching, the apex of the abdomen.

c. Wings extending beyond the apex of the abdomen. Color pallid, fulvous. Size medium, 30 mm. or more. [West Indies, Mexico, Central and South America].....*hexadactyla*<sup>2</sup> Perty.

cc. Wings about reaching the apex of the abdomen. Color dark fulvous. Size small, 23-26 mm. [Mexico, Central America, and West Indies]

*intermedia* Saussure.

bb. Wings abbreviated or missing, never reaching the apex of the abdomen.

Tegmina of moderate length.

c. Larger, about 30 mm. Both sexes always provided with wings. Anterior tibiae with the dactyls moderately elongate. [West Indies]

*borealis* Burmeister.

cc. Smaller, about 25 mm. The male usually without wings. Anterior tibiae with the dactyls short and obtuse. [Argentina]

*claraziana* Saussure.

## 2. *Neocurtilla minor* sp. nov.

Slender, minute, without wings, and with much abbreviated tegmina.

General color dark brown, the terminal tergites of the abdomen plainly longitudinally fasciate with testaceous on each side of the middle. Legs above paler than the almost uniformly colored pronotum, below and at base dirty testaceous or ochraceous. Claws of anterior tibiae and tarsi robust, piceous, the outer tibial claw longest, the inner shortest. Process of the anterior trochanters moderately large, roundly triangular, the lower margin studded with graduated tooth-like spines or bristles, the longest being at the apex; auditory apparatus large and prominent, elliptical, located above and back of the center of the first tibial dactyl at a distance equal to its longest diameter. Pronotum minutely velvety, elliptical, the center provided with a depressed longitudinal area, widest anteriorly; the front margin roundly emarginate. Head elongate, narrowing forward, the front quite prominently and angulately ridged from a little in advance of the ocelli to between the base of the antennae. Ocelli prominent, slightly transverse, the vertex between them transversely tumid. Eyes fairly prominent, one and one-half times as long as broad, the facets prominent. The hind legs scarcely saltatorial, the tibiae subfusiform.

Length of body, ♂ (?), 18 mm.; of pronotum, 5.5 mm.; width of pronotum, 4 mm.; length of tegmina, 4 mm.; of hind femora, 4.1 mm.

<sup>2</sup> *N. hexadactyla* var. *spinosa* Chopard has a single spine at the middle of the inner margin of the hind tibiae according to that author.

*Habitat*.—The only specimen at hand, the type, comes from Rio Mamoré, Bolivia, where it was taken "between the farm Berlin and Guaja Mirim, Sept. 16–24, 1909, by J. D. Haseman." This specimen is very imperfect, since it lacks both the antennæ and the cerci. It is by far the smallest representative of the genus as well as of the family thus far discovered. It is the property of the Carnegie Museum.

### 3. *Neocurtilla hexadactyla* (Perty).

*Gryllotalpa hexadactyla* PERTY, Del. Anim. Art. (1832), p. 119, Pl. 23, fig. 9; BURMEISTER, Handb. Ent., II (1838), p. 740; SCUDDER, Mem. Peabody Acad. Sci., I (1869), p. 27, Pl. I, figs. 17, 37, 38.

var. *Gryllotalpa azteca* SAUSSURE, Rev. Zoöl. (2), XI (1859), p. 316.

*Gryllotalpa hexadactyla* var. *azteca* SAUSSURE, Miss. Mex., Orth., (1874), p. 345; Biol. Cent.-Amer. Orth. I (1894), p. 200.

*Neocurtilla hexadactyla* KIRBY, Syn. Cat. Orth., II (1906), p. 2.

*Habitat*.—This insect has a very wide distribution in tropical and subtropical America. Specimens are at hand from the following localities: Pará and Chapada, Brazil (H. H. Smith); Rio Grande, Bahia, Dec. 30, 1907, Lagoa Feia, Tocos, Espirito Santo, June 29, 1908, and Raiz de Serra, near Santos, São Paulo, July 26, 1908 (J. D. Haseman); Puerto Suarez, Bolivia, 150 M., Nov. 1908–Jan. 1909 (J. Steinbach). There is also a female specimen in the writer's collection taken at Rosario, Argentina, by H. Stempelmann.

In addition to the two species just referred to I find a single specimen of *N. borealis*, Burmeister, in the material now being studied. It bears the locality label "Pittsburg, Pa."

The species *N. claraziana* Saussure, is represented in the writer's collection, and was taken by him at Carcaraña, Argentina, during his visit to that country in 1897–8.

### Genus *SCAPTERISCUS* Scudder.

*Scapteriscus* SCUDDER, Proc. Bost. Soc. Nat. Hist. XI, (1868), p. 385; Memoirs Peabody Acad. Sci., I, (1869), p. 6; SAUSSURE, Miss. Mex., Orth. (1874), p. 336; Mém. Soc. Genève, XXV (1877), p. 36; GIGLIO-TOS, Boll. Mus. Torino, IX (1894), No. 184, p. 43.

The genus *Scapteriscus* is confined to the Americas, where it is represented by approximately a dozen species, most of which occur in South America. While there is a great variation among these distinct forms in size and length of wing, many of them are very similar in general appearance and rather difficult to determine. The annexed table will in a measure aid in their separation, although the characters here employed are rather superficial and not very structural in nature:



SYNOPSIS OF THE SOUTH AMERICAN SPECIES OF *SCAPTERISCUS*.<sup>3</sup>

- A. Tegmina covering more than one-half of the abdomen.
- b. Size very large (length 45–50 mm.). Color pale testaceous, the pronotum with an irregular discal fuscous patch. [Brazil, to Middle Argentina]  
*oxydactylus* Perty.
- bb. Size smaller (length 25–35 mm.) Color variable, but darker than in the alternate category.
- c. Size small, slender (25 mm.); pronotum less than 6 mm. in length; front trochanter with the lower outer apex angulate and produced downwards. [Brazil].....*tenuis* Scudder.
- cc. Size larger and more robust (28–35 mm.). Pronotum 7 mm. and upwards in length. Anterior trochanter with the blade variable, but never hooked or produced downwards at the apex.
- d. Tibial dactyls or fingers distant from each other at base by at least one-half the width of one of the dactyls.
- e. Edge of the bare blade on the lower border of the anterior trochanter rounded. Tibial dactyls separated by one-half the width of the lower one.
- f. Head, pronotum, dorsal edge, and upper half of the outer face of the hind femora rather heavily marked with fuscous. [Mexico, Central and South America, and West Indies]  
*didactylus* Latreille.
- ff. Head, pronotum, dorsal edge and upper half of the outer face of the hind femora less heavily blotched with fuscous. [Paraguay].....*camerani* Giglio-Tos.
- ee. Edge of the bare blade on the lower border of the anterior trochanter straight. Tibial dactyl separated by a space nearly equal to the width of the lower one.
- f. Apical segment of the hind tarsi strongly dilated, fully one-half as wide as long. Legs strongly and closely hirsute. [Mexico, Colombia, and Brazil].....*mexicanus* Burmeister.
- ff. Apical segment of the hind tarsi less strongly dilated, only about one-third as wide as long. Legs sparsely hirsute. [Paraguay, Argentina].....*borellii* Giglio-Tos.
- dd. Tibial dactyls or fingers almost, or quite, touching at their base.
- c. Tegmina covering nearly the whole abdomen. [Central and South America].....*vicinus* Scudder.
- ee. Tegmina covering not more than two-thirds of the abdomen. [Brazil and West Indies].....*agassizi* Scudder.
- AA. Tegmina covering only one-half of the abdomen or less.
- b. Tegmina one-half the length of the abdomen, the hind wings shorter than the abdomen, but one-half longer than the tegmina. Trochanter of front legs large, flattened, the sides parallel, rounded at the extremity. [Northern South America].....*variegatus* Scudder.

<sup>3</sup> An occasional depauperate individual of other species may be small, but still possess the structural features credited to those species.

*bb.* Tegmina less than one-half the length of the abdomen, the hind wings more or less aborted.

*c.* Wings not at all or barely passing the tegmina, the abdomen marked above with some regular pale spots. [Colombia]. *.parvipennis* Serville.

*cc.* Wings abortive, not more than one-half the length of the tegmina. [Pernambuco, Brazil]. . . . . *abbreviatus* Scudder.

#### 4. *Scapteriscus oxydactyla* (Perty).

*Gryllotalpa oxydactyla* PERTY, Del. Anim. Art. (1832), p. 118, pl. 23, fig. 9; BURMEISTER Handb. Ent., II (1838), p. 74; SERVILE, Ins. Orth. (1839), p. 307.

*Scapteriscus oxydactylus* SCUDDER, Mem. Peabody Acad. Sci., I (1869), 7, pl. 1, figs. 2, 21.

*Scapteriscus oxydactyla* SAUSSURE, Miss. Mex., Orth. (1874), p. 337.

*Habitat.*—One female and one male specimen are before me. They come from Santa Cruz de la Sierra, Province del Sara, Bolivia, where they were taken in 1909 by J. Steinbach. There is also a female bearing the label "Cacequy, Rio Grande do Sul, Brazil, Feb. 2, 1909 (J. D. Haseman)." The writer also has specimens which were collected as far south as the city of Rosario, Argentina.

#### 5. *Scapteriscus borellii* Giglio-Tos.

*Scapteriscus borellii* GIGLIO-TOS, Boll. Mus. Torino, IX (1894), p. 45, figs. 12, 15; KIRBY, Syn. Cat. Orth., II (1906), p. 1.

*Habitat.*—While there are no specimens contained in the collection now being reported upon, there are a number of specimens in the writer's possession. These were taken at various localities in Argentina, as well as at San Bernardino and Asunción, Paraguay.

#### 6. *Scapteriscus mexicanus* (Burmeister).

*Gryllotalpa mexicana* BURMEISTER, Handb. Ent. II (1838), p. 740.

*Scapteriscus mexicanus* SCUDDER, Mem. Peabody Acad., I (1864), p. 9, pl. 1, figs. 6, 18; SAUSSURE, Miss. Mex., Orth. (1874), p. 337; KIRBY, Syn. Cat. Orth., II (1906), p. 1.

*Habitat.*—Only a single male specimen of this species is at hand. It comes from San José, Costa Rica, where it was taken by P. Biolley. As shown by the synoptical key it and the preceding species are quite closely related.

#### 7. *Scapteriscus didactylus* (Latreille).

*Gryllotalpa didactyla* LATREILLE, Gen. Crust. Ins., XII (1804), p. 122; BURMEISTER, Handb. Ent., II (1838), p. 740.

*Scapteriscus didactylus* SCUDDER, Mem. Peabody Acad. Sci., I (1869), p. 10, pl. 1, figs. 1, 14; SAUSSURE, Miss. Mex., Orth. (1874), p. 338, pl. 8, fig. 20.

*Gryllotalpa tetradactyla* PERTY, Del. Anim. Art. (1832), p. 118, pl. 23, fig. 8.

*Habitat.*—There are several specimens at hand which are referred

to this species. They come from Corumbá and Pará, Brazil (H. H. Smith). A single small female (25 mm. in length) coming from "Dutch Guiana" (O. G. Schultze) is also referred here. A still more depauperate specimen (22 mm.) labeled "Santa Cruz de la Sierra, Prov. del Sara, Bolivia, 1909, J. Steinbach" may also belong to this species.

In the writer's private collection are specimens of *didactylus* taken in several of the West Indian Islands and various parts of South America.

#### 8. *Scapteriscus vicinus* Scudder.

*Scapteriscus vicinus* SCUDDER, Mem. Peabody Acad. Sci., I (1869), p. 12, Pl. 1, figs. 4, 23; KIRBY, Syn. Cat. Orth., II (1906), p. 2.

*Habitat*.—Specimens classified as this species bear the following labels: "Puerto Suarez, Bolivia, Nov., '08-Jan., '09 (J. Steinbach)," five females; "Sta. Cruz de la Sierra, Prov. del Sara, Bolivia," one female, also taken by J. Steinbach. The writer also possesses a single female specimen, which he took at Las Palmas, Chaco, Argentina, in 1897.

#### SYNOPSIS OF THE SOUTH AMERICAN GENERA OF TRIDACTYLIDÆ.

- A. Body smooth, punctate. Head directed anteriorly, narrowing towards the front; ocelli arranged in a transverse line. Middle tibiæ fusiform. Inferior anal appendages styliform. Wings nearly normal.
- b. Size usually more than 5.5 mm. long. Pronotum furnished with a delicate transverse, but well-defined sulcus near the middle of the anterior half. Front tibiæ of males sometimes deeply fissate; hind tibiæ with three or four pairs of long natatory lamellæ, preceded by slight serrations, and armed at the tip on either side with two very unequal calcaria, the longest scarcely longer than the metatarsus, the only member of the tarsus present.

#### *Tridactylus*.

- bb. Size usually less than 5.5 mm. in length. Pronotum without a well-defined transverse sulcus. Front tibiæ of male never fissate. Hind tibiæ with a single pair of natatory subapical lamellæ or none; the margins of the hind tibiæ usually, but not always, smooth, armed at the tip on either side with two very unequal calcaria, the longest about half as long as the tibiæ, the tarsus wholly wanting, or at least practically invisible. . . . . *Ellipes*.
- AA. Body velvety. Head vertical. Ocelli arranged in an arcuate line. Middle tibiæ slender. Inferior anal appendages compressed. Wings with the anterior field horny, smallest, the posterior field largest. . . . *Rhipipteryx*.

#### Genus TRIDACTYLUS Olivier.

*Tridactylus* OLIVIER, Enc. Meth., Ins., IV (1789), p. 26; LATREILLE, Hist. Nat. Crust., Ins., III (1802), p. 276; SAUSSURE, Rev. Suisse Zool., IV (1897), pp. 407-419 and authors in general to date.

*Xya* LATREILLE, Gen. Crust. Ins., IV (1809), p. 383; BURMEISTER, Handb. Ent., II (1838), p. 741, etc.

*Heteropus* PALISOT DE BEAUVOIS, Ins. Afr. Amer. (1805), p. 231.

The representatives of this genus are to be met with throughout the warmer parts of the earth, where they are confined to low wet places on the margins of streams, ponds, lakes, swamps, etc. They are strongly aquatic in habit, often swimming about on the surface of the water seemingly for the mere pleasure of it. At other times they burrow beneath the mud and wet sand as do representatives of the family Gryllotalpidæ. They are essentially herbivorous and may be collected by sweeping the grass and other vegetation growing about their haunts. They may be collected also on mud and wet sand when the weather is warm and the sun shines brightly. The number of forms of these little cricket-like insects appears to be much greater than published accounts would indicate, since there are many variations in size and color-markings among them, as taken in different regions, although these characteristics appear to be quite constant with the individuals in each of these localities.

Some of the characters which have been employed in separating these interesting little insects are such as general form, color, size, puncturation, presence or absence of spines or lamellæ on the hind tibiæ, form of anal segments of the abdomen, shape of anal appendages, or lamellæ, smoothness of body, etc. Although some of these characters seem to be indicative of groups rather than of species, it is quite a difficult matter to decide definitely as to their real value without a very careful study of the living insects from a number of localities.

Up to this time but few published references as to the actual occurrence of representatives of the genus exist for South American localities. Judging from material now at hand and the experience of the present writer while collecting orthopterous insects in several localities in Brazil, Paraguay, and Argentina, the conclusion might be arrived at that the reason for this absence of records of occurrence and of the insects themselves is largely due to the neglect of collectors rather than to the absence of the insects.

The forms which are separated by the annexed synoptic table occur in one or more of the South American countries. Undoubtedly some of the species, which have been taken and reported in Mexico, Central America, and the West Indies, will be found to occur in South America as well, but until that time they will not be included in this key.

## SYNOPSIS OF SOUTH AMERICAN SPECIES OF TRIDACTYLUS.

- A. Pronotum throughout quite closely and rather strongly punctate. Entire surface of the body and legs opaque or lusterless. General color deep black. Size medium (length of body, 7-8 mm.) . . . . . *obscurus* sp. nov.
- AA. Pronotum and other portions of the body and legs glabrous, almost impunctate. General color variable. Size also variable (5-8 mm.)
- b. Size larger and form moderately robust (7-8 mm.). Color pallid, but more or less variegated, the darker markings irregular and vague in their outline. [Bolivia, Paraguay, and Argentina] . . . . . *australis* sp. nov.
- bb. Size smaller (4.75-5 mm.). Color darker, or at least with the darker markings definite and well-defined.
- c. Form moderately robust. General color black, reminding of the much larger *obscurus*. [Brazil & Bolivia] . . . . . *atratus* sp. nov.
- cc. Form rather slender. General color pallid, but with well-marked fuscous patches on the pronotum, tegmina, and legs. [Bahia, Brazil].  
*politus* sp. nov.

9. *Tridactylus obscurus* sp. nov.

Rather above the medium in size, a very dark-colored, almost black, insect, the chief characteristic of which is its dull or opaque surface and the closely punctulate pronotum and front.

Head moderately large, the front between the antennæ broad and convex, closely and deeply punctate, the ocelli large and prominent, clypeus large, and with the apex broadly and evenly rounded. Pronotum without a well-defined transverse impressed line anteriorly. Tegmina broad, a little more than one-half the length of the abdomen, their apex broadly rounded. Wings lengthily caudate, reaching well beyond the apex of the hind femora and the tip of the abdominal appendages. Hind tibiæ provided with large natatorial appendages, the lateral canthi furnished with several large teeth or serrations and the superior claws strongly hooked at their apex. Last ventral segment broadly rounded at its apex, the preceding one a little broader than long, its apex bilobed (♀) or entire (♂). Anterior tibiæ broadly longitudinally canaliculate internally, the apex four-spined and somewhat fissate at its middle.

General color, as stated above, dull black, in some specimens showing a tendency towards variegation with pale markings on the tegmina and femora. Wings pallid, with the dorsal edge beaded with fuscous. Underside slightly paler, but still infuscated or tinged with fuscous.

Length of body ♀ & ♂, 7-8 mm. to tip of wings, 9.5-10.5 mm.

*Habitat*.—The type (♀) comes from Santarem, Brazil, where it was



collected by H. H. Smith. Other specimens also were taken at the same place. In addition to these there are some other specimens at hand coming from Corumbá, May, and Pedro Blanco, April (H. H. Smith), while a single specimen bears the label "Puerto Suarez, Bolivia, 150 M. Nov. '08-Jan. '09. (J. Steinbach)."

10. *Tridactylus australis* sp. nov.

About the same in size as the preceding, but differing from it in having the body glabrous and nearly impunctate, even on both the pronotum and the front between the eyes. General color smoky-white or pale flavous, with the sides of the pronotum, base of the tegmina, and outer face of the hind femora showing traces of clouded patches. Pronotum near its anterior part showing plainly the transverse impressed line mentioned in the synoptic table of genera. Apex of the clypeus broadly and roundly, or arcuately, emarginate. Last ventral segment of the abdomen of the female scoop-shaped, the apex rounded, entire; the preceding segment with its apex gently bilobed, a little more than twice as wide as long; in the male the apical segment, or subgenital plate, has the apex somewhat emarginate, and the preceding segment nearly, or quite, entire.

Length of body, ♂, 6.5 mm., ♀, 7.5 mm.; to tip of wings, ♂, 8 mm., ♀, 9.5 mm.

*Habitat*.—The types, ♂ & ♀ *in coitu*, come from Formosa, Chaco, Argentina, where they were taken by the writer in September, 1897. Other specimens are at hand from the same place, and still others come from Carcaraña and Cruz del Eje, Argentina, and San Bernadina, Paraguay. The Carnegie collection contains a specimen from the "Province del Sara, Bolivia, 450 M. (J. Steinbach)."

11. *Tridactylus atratus* sp. nov.

At first glance suggesting a diminutive of the *T. obscurus*, described in this paper, but upon examination found to be without the dull surface and puncturation so characteristic of that species.

Moderately robust, the front evenly rounded and provided with a few rather large punctures, the clypeus short, transverse, its apex truncate. Pronotum evenly rounded, without a very definite transverse impressed line in advance of the middle, the surface shining, provided with a few scattered punctures. Hind femora robust. Hind tibiæ provided with natatory appendages and the carinæ with

several fairly coarse teeth or serrations. Anterior tibiae somewhat similar to those described in *T. politus*. The apical segments of the abdomen rather hirsute, the subgenital plate with its apex widely emarginate, and the apex of the preceding segment entire, nearly truncate.

Length of body, 5.1 mm.; to tip of wings, 7 mm.

*Habitat*.—The type of this species comes from Puerto Suarez, Bolivia, where it was taken by J. Steinbach at an elevation of 150 meters above sea-level. There are also two other specimens at hand. One of these latter comes from Santarem and the other from Benevides, Brazil (July). These latter specimens were presumably taken by H. H. Smith. All three belong to the Carnegie Museum.

#### 12. *Tridactylus politus* sp. nov.

Small, slender, and of a pale ground-color with prominent markings of fuscous on the head, pronotum, tegmina, and middle and hind femora, and with a highly polished or glabrous surface.

Head of medium size, the front short, the clypeus narrowed anteriorly and with its apex roundly emarginate. Anterior portion of the pronotum showing a well-defined, slender, transverse, impressed line. Wings caudate, slender, extending fully one-fourth of their length beyond the tips of the hind femora and abdomen. Next to the last ventral segment of the abdomen of the male rather large, the outer or apical portion thickened, brunnaceous, and with the apex broadly rounded, entire; the last segment semimembranous, gently tapering, its apex truncate. Anterior tibiae short, quadridentate, the internal face widely channeled.

Length of body, ♂, 4.85 mm.; to tip of wings, 6.6 mm.

*Habitat*.—"Morro do Pará, on Rio San Francisco, Bahia, Brazil. Dec. 6, 1907, Haseman." The type and a second specimen bearing the same locality-label and date are deposited in the Carnegie Museum.

#### Genus *ELLIPES* Scudder.

*Ellipes* SCUDDER, *Psyche*, IX (1902), p. 309; BLATCHLEY, *Rept. Indiana Dept. Geol.*, XXVII (1903), pp. 410, 415; KIRBY, *Syn. Cat. Orth.*, II (1906), p. 11.  
*Heteropus* SAUSSURE (*nec*. Palisot de Beauvois), *Miss. Mex.*, *Orth.* (1873), p. 351;  
*Mém. Soc. Genève*, XXV (1877), p. 47; *Suisse Zoöl.*, IV (1896), p. 419; *Biol. Cent.-Amer.*, *Orth.*, I (1896), pp. 204, 207.

These little cricket-like insects are found in places similar to those

frequented by representatives of both the genera *Tridactylus* and *Rhipipteryx*. They seem to be most nearly related to the former, however, and have similar habits. While quite widely distributed over the warmer parts of the Americas, they do not seem to be as well known as the representatives of either of the above mentioned genera. Wherever found they occur rather abundantly. Possibly, if specially sought for, other species would be found. The characters employed in separating the forms are similar to those used in the two other genera just referred to. The following key is suggested as an aid in separating the South American species.

SYNOPSIS OF SOUTH AMERICAN SPECIES OF ELLIPES.

- A. Posterior tibiæ strongly toothed, the apical spurs hooked; metatarsi present.  
*denticulatus* Saussure.
- AA. Posterior tibiæ without teeth or spines, the apical spurs variable.
  - b. Metatarsi present, but abortive, not conspicuous. Hind tibiæ with their margins entire, bearing at the apex one to two movable spines.  
*histrío* Saussure.
  - bb. Metatarsi none.
    - c. Hind tibiæ at the apex on each side provided with a carinule which has the appearance of a styliform appendage not separated from the tibiæ.  
*histrionicus* Saussure.
    - cc. Hind tibiæ at apex without either natatory lamella or attached styliform carinules. . . . . *minimus* sp. nov.

13. **Ellipes histrío** (Saussure).

*Tridactylus* (*Heteropus*) *histrío* SAUSSURE, Biol. Cent.-Amer., Orth., I (1896), p. 207.  
*Ellipes histrío* KIRBY, Syn. Cat. Orth., II (1906), p. 11.

*Habitat*.—The present collection contains specimens as follows: Chapada, Brazil, Jan. and May 4; Corumbá, May 2 (H. H. Smith collector); Puerto Suarez, Bolivia, 250 M., two (J. Steinbach).

These insects which are referred here seem to agree fairly well with the description of the species as characterized in the accompanying synoptical key. The movable spines near the apex of the hind tibiæ, one on one side and two on the other, are quite characteristic of it, as compared with representatives of the next species, which is entirely without either the spines or the natatory lamellæ, as well as the carinæ described in connection with the apex of the tibiæ of *E. histrionicus*.

14. **Ellipes minimus** sp. nov.

Related to *E. histrionicus*, but differing from it in lacking even the styliform attached carinæ, which characterize that species, when com-

pared with *histrío*, which latter, as indicated in the synopsis, has the apex of the hind tibiæ provided with one to two movable spines, instead of natatory lamellæ as in *Tridactylus*.

Rather slender in general form, the folded wings extending fully one-fourth of their length beyond the apex of the abdomen in both sexes. General color rather dark, varied with flavous arranged in patterns much as in the other species of the genus. Penultimate segment of the female abdomen roundly triangulate, the last or apical segment subquadrate, narrowest at its tip, with the apical margin a little advanced at middle, rather heavily clothed with elongate robust hairs; these segments of the male abdomen are quite similar to those of the insect with which comparison is above made, but with the penultimate segment much shorter than in it.

Length of body, ♂, 3.15 mm., ♀, 4 mm.; length to tip of the wings, ♂, 4 mm., ♀, 4.7 mm.

*Habitat*.—The specimens at hand come from Chapada, Matto Grosso, Brazil, Jan., Mch, May (H. H. Smith); Jacaré, Minas Geraes, Brazil, Dec. 11, 1907 (J. D. Haseman).

The types, ♂ and ♀, are from Chapada. They are deposited in the Carnegie Museum.

#### Genus RHIPPTERYX Newman.

*Rhippteryx* NEWMAN, Ent. Mag., II (1834), p. 204; Brullé, Hist. Nat. Ins., IX (1835), p. 198; BURMEISTER, Handb. Ent., II (1838), p. 742) BLANCHARD, Hist. Ins., III (1840), p. 413.

*Rhippteryx* SERVILE, Ins. Orth. (1839), p. 316; SAUSSURE, Miss. Mex., Orth., V (1873), p. 354; Biol.-Cent. Amer., Orth., I (1896), p. 208, etc.

The representatives of the genus *Rhippteryx* are confined to the American tropics, where numerous species are known to occur. These insects are quite active and live mostly upon vegetation in damp localities similar to those frequented by the species of both *Tridactylus* and *Ellipes*. Unlike them, however, they do not burrow in the mud and damp sand, but live above ground, as do the grouse-locusts or Tetrigidæ among the Acridoidea or Locustoidea. These insects also seem to be rather closely related to the Locustoidea and particularly to the grouse-locusts in some of their structural characters as well as in their habits. This is especially true of the form of the ovipositor, which is composed of four toothed and hooked valves, which work in opposite directions when drilling for ovipositing.

Most of the species of the genus are confined to South American countries, where representatives of the group may be looked for at suitable localities from ocean to ocean and from the Isthmus of Panama to Bolivia, Paraguay, and northern Argentina. Since practically all of the described forms are from this continent, they will be included in the annexed synoptical key, which is given for the purpose of showing the relationships of the new forms described herewith.

So far as known the coloration and size of the different species are fairly constant, hence these characters will be largely employed in their separation.

## SYNOPSIS OF THE SPECIES OF RHIPIPTERYX.

## A. Larger species (9-14 mm. including wings).

## b. Entirely black, the claws of the hind tibiæ also black.

## c. Antennæ with the sixth antennal joint above yellowish white.

d. Length of the body to tip of the wings 9.2 mm. [Panama, on Volcano Chirique]. . . . . *carbonaria* Saussure.

dd. Length of body including the wings only 8 mm. [Bogotá].

*atra* Serville.

## cc. Antennæ with most, or at least the apical, joints pallid in color. Metatarsus and claws unequal in length.

d. Three apical joints of the antennæ pallid, the remaining joints black, or infuscated. Length of the body including the wings 13 mm. [U. S. of Colombia]. . . . . *forceps* Saussure.

dd. Two apical joints black, the remaining joints pallid. Length(?). [Department of Santa Cruz, Bolivia]. . . . . sp. nov.

## bb. Variegated with yellow or rufous. Claws of the hind tibiæ pallid.

## c. Disc of the pronotum immaculate, not marked with yellow or dirty white.

d. Size smaller (10.5 mm. including the wings). First four of the antennal joints above pallid, the apical joint entirely and the penultimate one partly so. Metatarsus of the hind tibiæ of equal length with the claws. [Guiana, Brazil, and Central America].

*limbata* Burmeister.

dd. Size larger (11.5-14 mm.). Metatarsi shorter than the claws.

e. Scutellum of the face flavo-bimaculate. Anterior and middle femora broadly bordered with, or entirely, flavous. Hind femora not bordered above with yellow. Size 11.5 mm. to tip of wings. [Nicaragua and S. America]. . . *hydrodroma* Saussure.

ee. Scutellum of the face immaculate. Anterior femora entirely black, middle pair bordered below, hind femora bordered both above and below, with flavous. Size 12.5 mm. to 14 mm. to tip of the wings. [Tropical America]. . . *circumcincta* Saussure.

## cc. Disc of the pronotum largely pallid, or at least marked with this color.

d. Pronotum for the most part pallid, or with the disc conspicuously dotted and marked with black.



- e.* Legs and tegmina also chiefly pallid. Length of body including the wings 13 mm. [Dept. Santa Cruz, Bolivia]. *.boliviana* sp. nov.
- ee.* Legs and tegmina largely fuscous, more or less strongly tinged with dull ferruginous. Pronotum conspicuously marked with large black patches.
- f.* Black patches of the pronotum three in number, one dorsal, the others lateral, separated by two broad anteriorly converging pallid bands reaching from the hind to front margins. Length including the wings 10 mm. [Pará, Brazil].  
*trilobata* Saussure.
- ff.* Black patches of the pronotum four in number, one on each side, one parallel to its anterior border, and the fourth dorsal, back of its middle, separated by two prominent decussating lines which cross just in advance of the middle of the disc. Length to tip of the wings 11 mm. [Cuyabá, Brazil].  
*cruciata* sp. nov.
- dd.* Pronotum largely black, the disc more or less prominently obliquely marked with flavous lines on each side. (Length of tip of the wings 10 to 13 mm.)
- e.* Body and legs rather heavily or widely marked with flavous or dirty white. Posterior metatarsus ovate-conical, entirely pallid in color or at least so apically, one-third shorter than the claws or spurs.
- f.* Smaller, 11-11.5 mm. to tip of the wings. Apical field of the wings more or less violet-tinged.
- g.* Tegmina pale-bordered throughout, the disc with a subcostal heavy longitudinal pale patch. Middle and hind femora pale-bordered both above and below. [Island of Trinidad; Colombia, Guiana]. *.rivularia* Saussure.
- gg.* Tegmina with their sutural margins and the apex pale-bordered and white-spotted. Hind femora pale-margined above. [Pará, Brazil]. *.marginata* Newman.
- ff.* Larger, 13 mm. to tip of the wings. Wings beyond the pallid transverse line shining violet in color. [Guianas, Venezuela, and Surinam]. *.cyanipennis* Saussure.
- ee.* Body and legs narrowly marked with flavous. Posterior metatarsus large, entirely black; wings with their apical field black, not at all violaceous. Length of body 9.2 mm.; to tip of the wings, 11 mm. [Chapada, Brazil]. *.brullei* Serville.
- AA.** Smaller species (4.1 to 7.5 mm.).
- b.* Minute, black, or rufous, varied with flavous. Eyes moderately remote, at least as far apart as the width of one of them. Face between the antennal scrobes of the male with a transverse, swollen, yellow line. Posterior metatarsi somewhat elongate.
- c.* The flavous facial line of the male marked with three black impressions, or face plain black.

d. Pronotal disc marked with a rufous patch, or with a couple of anteriorly directed yellow lines.

e. Pronotum not yellow-bordered in front; disc with ferruginous patch.

f. Slightly smaller, color black. [Mexican plateau].

*mexicana* Saussure.

ff. Slightly larger, more or less varied with rufous; black, hind femora with the apex rufous, or of that color throughout. [Vera Cruz, Guatemala, and other portions of the low country in Mexico and Central America]. *fraterna* Saussure.

ee. Pronotum entirely yellow-margined.

f. Disc of the pronotum with an elongate ferruginous maculation. Size smaller, 6.2 mm. with wings. [Southern Mexico, Costa Rica.].....*tricolor* Saussure.

ff. Disc of the pronotum furnished with two narrow strongly divergent yellow lines. Size larger, 7.5 mm. with the wings. [Chapada, Brazil].....*marginipennis* sp. nov.

dd. Pronotal disc immaculate, completely yellow-bordered. Color chiefly black. Size small, 6.5 mm. with the wings. [Costa Rica.]

*biolleyi* Saussure.

cc. The transverse facial line of the male roughly tumid, without the black impressions. Black, the pronotum completely yellow-bordered, provided with oblique discal margins. Length including the wings 7 mm. [Guererro, Mexico].....*scrofulosa* Saussure.

bb. Smallest, color dirty smoky-brown. Face between the antennæ of both sexes flat. Eyes close together, separated by a space scarcely more than one-fourth the width of one of them. Posterior metatarsus very short. Size to tip of the wings 4.1 mm. [Lower Mexico; Peru].

*pulicaria* Saussure.

### 15. *Rhipipteryx forceps* Saussure.

*Rhipipteryx forceps* SAUSSURE, Biol. Cent.-Amer., Orth., I (1896), p. 201, Pl. II, fig. 23; KIRBY, Syn. Cat. Orth., II (1906), p. 11.

*Rhipipteryx atra* SAUSSURE (*non* Serville), Miss. Mex., Orth. (1874), p. 361.

The collections now being reported upon contain two specimens, which seem to belong here, rather than to either *R. atra* Serville or *R. carbonaria* Saussure, both of which are also reported as occurring in Colombia. As indicated in the foregoing synopsis of species, the pallid joints of the antennæ do not agree with the descriptive matter, where the insects are more fully described.

*Habitat*.—Bogotá, Colombia. Carnegie Museum, Acc. No. 2306.

### 16. *Rhipipteryx* sp.?

There are two immature specimens of a second entirely black *Rhipipteryx* at hand coming from the Upper Mamoré river, Dept. of

Santa Cruz, Bolivia, at an elevation of 1,200 meters above sea-level, where they were taken by Steinbach during the month of December, 1913. They form part of Accession No. 5016. These insects, while immature, show that they are quite distinct from the three known black forms, since the antennæ are all white except the two apical joints which are black. Their extreme southern habitat, together with the entire absence of records of similar forms from intervening localities seems to point to their distinctness. These insects are likewise preserved in the entomological collections of the Carnegie Museum.

17. *Rhipipteryx circumcincta* Saussure.

*Rhipipteryx circumcincta* SAUSSURE, Miss. Mex. (1874), p. 358; KIRBY, Syn. Cat. Orth., II (1906), p. 12.

*Habitat*.—Four specimens are at hand. Three of them come from Benevides, Brazil, where they were taken by H. H. Smith during the month of July, and the fourth bears the label "Pará." It was also collected in July and presumably by H. H. Smith.

18. *Rhipipteryx boliviana* sp. nov.

Almost the maximum in size for the genus. A very striking insect in appearance, since it is prevailinglly dirty white or pale gray in color. The pronotum is marked with dashes and dots of black to the number of eight as follows: a longitudinal, large wedge-shaped line, the point in front, on the middle of the disk, extending from near the hind margin a little more than halfway towards the front; a moderately large transverse elliptical patch on each side, about midway between the posterior and anterior margins; and a series of five patches parallel to the anterior edge, the one in the middle a mere dot, the others larger. Anterior tibiæ rather broadly and deeply sulcate on their inner face. Last ventral abdominal segment of the abdomen of the male black, elongate, prow-shaped, with the apex finely acuminate, preceded by a raised keel, on the sides of which are two roundish protuberances. Cerci, or what seem to be such, white, with dusky apex, rather long, slightly enlarged apically, and rounded, the lower apical edge provided with a long, slender, black spine. A second, but much slenderer and shorter, pair of stylets in advance of these, black. Abdominal segments very broadly white-margined. Legs dirty white, except for the infuscated knees and somewhat darkened apex of the

middle and hind tibiae. Posterior metatarsus and tibial claws white, the former slender, about two-thirds as long as the claws. Antennae with the two basal joints entirely pallid, the next three pallid above, and the upper side of the sixth narrowly streaked lengthwise with same color; lower sides of the third to the sixth, and all of the remaining segments black. Tegmina with the sutural half pallid, the other half infuscated. Wings with their costal margin pale, tinged with violet, the remainder pale metallic blue with mother-of-pearl or iridescent reflections.

Length of body, ♂ and ♀, 8.5 mm.; including the wings, 12.5-13 mm.

*Habitat*.—The three specimens at hand all come from the "Upper Mamoré River, Department of Santa Cruz, Bolivia, 200 M." They were taken by Steinbach. The types, ♂ and ♀, belong to the Carnegie Museum.

#### 19. *Rhipipteryx trilobata* Saussure.

*Rhipipteryx trilobata* SAUSSURE, Miss. Mex., Orth. (1874), p. 357; KIRBY, Syn. Cat. Orth., II (1906), p. 12.

*Habitat*.—Three specimens of a *Rhipipteryx* which are referred to this species, come from Pará, Brazil, where they were taken during the months April and July, by H. H. Smith. They belong to the Carnegie Museum.

#### 20. *Rhipipteryx cruciata* sp. nov.

Re ated to *R. trilobata*, but somewhat larger and more robust, and with the black of the pronotum separated into four tracts by two decussating pallid lines, which extend from the sinus of one side to the opposite lower anterior angle. Head comparatively large, the eyes also large but not prominent, bordered by a pallid line; occiput marked by two rufotestaceous lines converging behind, the posterior ends of which are hidden by the front edge of the pronotum. Pronotum large, wide, rather broadly bordered with pallid, and having the disc crossed diagonally with two prominent lines of the same color in such a manner as to break up the black ground-color into four patches, the largest almost circular and situated dorsally back of the middle, the two lateral spots central, triangular, with their apices directed upwards, the anterior spot fairly wide, continuous, parallel with the anterior border, widest dorsally and reaching from near the

lower edges. Antennæ with joints one to six largely pallid. Anterior tibiæ strongly infuscated; knees and apex along with the tarsi of the middle legs and knees and most of the tibiæ of the hind legs also infuscated; posterior metatarsus and tibial claws pale testaceous, the former elongate-elliptical, moderately heavy, and rather closely fringed below with strong elongate hairs, nearly three-fourths the length of the claws. Hind femora marked with a narrow longitudinal line on the outer disc of each. Tegmina dimly banded with ferruginous and fuscous. Wings with the apical portion black. Abdomen black, the apices of the segments rather widely pallid; the apical segments similar to those in *trilobata*, but a trifle more robust.

Length of body, ♀ (?), 9 mm.; including the wings, 11.5 mm.

*Habitat*.—The only specimen at hand, the type, comes from Cuyabá, Brazil, where it was taken by H. H. Smith, in February. In the Carnegie Museum.

The pallid portions of this insect, except where otherwise stated, are ferrugineo-testaceous.

## 21. *Rhipipteryx rivularia* Saussure.

*Rhipipteryx rivularia* SAUSSURE, Biol. Cent.-Amer., Orth., I (1896), p. 212, pl. 11, fig. 20; KIRBY, Syn. Cat. Orth., II (1906), p. 12.

*Habitat*.—While the collections now being studied do not contain specimens of the above species, there are several examples of it in the author's collection which were taken on the Island of Trinidad. This record, therefore, establishes a wider distribution for the species. Specimens have also been seen by me which were taken in British Guiana.

## 22. *Rhipipteryx brullei* Serville.

*Rhipipteryx brullei* SERVILLE, Ins. Orth. (1839), p. 318; SAUSSURE, Miss. Mex., Orth. (1874), p. 357; Biol. Cent.-Amer., Orth., I (1896), p. 211, Pl. 11, fig. 21; KIRBY, Syn. Cat. Orth., II (1906), p. 12.

*Rhipipteryx marginatus* BRULLÉ, Hist. Nat. Ins., IX (1835), p. 198 (*non* Newman). *Tridactylus marginatus* PERCHERON, Gen. Ins. Orth. (1834), Pl. 1.

*Xya notata* BURMEISTER, Handb. Ent., II (1838), p. 742.

*Habitat*.—The collection contains a large series of this species, which were taken during June by H. H. Smith. They come from Chapada, near Cuyabá, Matto Grosso, Brazil.

The variation in both size and color is very little, even less than is usually to be observed in other species which are known to adhere closely to the type-form.



23. *Rhipipteryx marginipennis* sp. nov.

Related to *R. mexicana* and its allies, but with the pale markings on the disc of the pronotum similar to those of *brullei*, *marginata*, and *rivularia*.

Head of moderate size, the eyes with, or without, pale border on the surrounding portions of the face. Antennæ with the basal and three apical segments black, the second to the seventh segments largely pallid. Pronotum entirely and broadly pale-bordered, the disc furnished with two narrow anteriorly divergent lines. Middle femora pale-bordered below; the hind pair similarly bordered both above and below; the genicular area of the latter, except the lobes, which are largely black, tinged with dull ferruginous; the anterior tibiæ and the apex of the front femur tinged with fusco-ferruginous; hind metatarsus about as long as the tibial claws, gently acuminate. Tegmina and folded wings with their dorsal edge conspicuously pale-margined. Abdomen black, without pale margins on the apex of the segments. Tip of the abdomen rather simple.

Length of body of both male and female, including wings, 8 mm.

*Habitat*.—The collection contains two specimens, a male and a female, respectively, bearing the labels "Chapada, Nov." and "Chapada, April." There is also an immature specimen at hand which I am inclined to place here. It has the hind femora largely ferruginous and lacks the divergent pale lines on the disc of the pronotum. This latter specimen bears the label "Chapada, Matto Grosso, H. H. Smith, Acc. 2966."

24. *Rhipipteryx pulicaria* Saussure.

*Rhipipteryx pulicaria* SAUSSURE, Biol. Cent.-Amer., I (1896), p. 215, pl. 11, fig. 24;

KIRBY, Syn. Cat. Orth., II (1906), p. 13.

*R. pulicaria* var. *peruviana* SAUSSURE, l. c., p. 216; KIRBY, l. c., p. 13.

There are at least seventy-five specimens of what seems to be Saussure's *R. pulicaria*. This material comes from a number of localities in Brazil, Bolivia, and even from the Island of Trinidad. There is quite a wide range of variation among these specimens so far as color is concerned, as well as some in size. Specimens coming from Chapada and Corumbá, Brazil, were taken during nearly every month of the year by H. H. Smith; some were collected at Puerto Suarez, Bolivia, by J. Steinbach, while others bear the label "Jacoré, Minas Geraes, Brazil, Dec. 11, 1907," and were collected by Haseman. The

specimens coming from the Island of Trinidad are in the writer's collection, and were taken by H. D. Chipman. Saussure based the species on specimens coming from various points in warmer Mexico, and separated others from Peru as a variety which he called *peruviana*. I myself have taken it both in Mexico and Costa Rica.

Should all of these specimens belong to a single species, and they certainly seem to me to do so, as I have hastily compared them, this would give quite a wide range for it.

### Family NEMOBIIDÆ.

This family has a world-wide distribution, and contains a large number of small to medium-sized insects.

#### SYNOPSIS OF THE SOUTH AMERICAN GENERA OF NEMOBIIDÆ.

- A. Posterior metatarsus not sulcate nor serrate. Anterior tibiæ provided with an auditory opening on their outer side. Median vein of the tegmina undivided.
  - b. Male tegmina furnished with a tympanum. Front slightly convex, but not rostrate. Hind tibiæ provided on each side beyond the middle with four long movable pubescent spines and their apex with six distal spurs.
 

*Nemobius* Serville.
  - bb. Male tegmina without a tympanum. Front somewhat tuberculate between the bases of the antennæ. Hind tibiæ provided on each side with only three movable pubescent spines and the apex with five spurs, three external and two internal. . . . . *Hygronemobius* Hebard.
- AA. Posterior metatarsus slightly depressed, gently sulcate and serrate on the outer margin. Front tibiæ with the auditory opening on the inner face. Median vein of the tegmina branched. . . . . *Hemigryllus* Saussure.

### Genus NEMOBIUS Serville.

*Nemobius* SERVILLE, Ins. Orth. (1839), p. 345; FISCHER, Orth. Eur. (1853), p. 183; SAUSSURE, Miss. Mex., Orth. (1872), p. 380; Mém. Soc. XXV (1877), p. 68; Biol. Cent. Amer., Orth., I (1897), p. 221, and many others.

There are several other generic names which have been given to members of the genus, but these need not be mentioned here. (See Kirby, Syn. Cat. Orth., II, p. 14.)

Representative of the genus *Nemobius* are very widely scattered over the surface of the earth. In fact they occur on most of the continents and many of the islands within the temperate and tropical zones. The species are most numerous in tropical regions. Many of the species possess both long- and short-winged forms, and some also

vary considerably in size and color. Several of the species are aquatic, or at least semiaquatic, in habit.

The present collection contains only a small number of South American species. Possibly several of these are new and accordingly are described herewith. A table for separating all of the forms known to occur on this continent would undoubtedly be of considerable value to future workers, but until more material is available for the purpose I deem it hardly advisable to attempt the compilation of such a synoptical table. In August, 1913, Mr. Morgan Hebard published a revision of the species of the genus found in North America north of the Isthmus of Panama (*cf.* Proc. Acad. Nat. Sci. Philad., June, 1913). That very carefully prepared paper will be of much assistance in a similar study of the South American species.

25. *Nemobius meridionalis* sp. nov.

A medium-sized, smooth-bodied or glabrous insect, with prominent white spots on the upper edges of all the femora. The ovipositor is short and straight, much shorter than the hind femora, and its apex is evenly and finely serrated above. The tegmina are variable but somewhat shorter than the abdomen, the wings when present are caudate and greatly surpassing both the cerci and the tip of the ovipositor. Prothorax narrower in front than behind, with a well-defined humeral pale band; below this the sides are piceous, while the lower edge is broadly pale; disk somewhat conspersed with paler. Occiput more or less plainly pale quadrivittate. Head a little wider than the front edge of the pronotum, the eyes rather prominent.

General color above piceous, varied more or less on the pronotum and below with pale testaceous in some specimens, the humeral angle and costal area of the tegmina are varied with a greenish tinge. The tibiae are fasciate with light and dark, and the tarsal joints have their apices dark. Hind femora pale brown and testaceous, their upper edges prominently tripunctate with dirty white, these light-colored markings being located just beyond stiff dark-colored hairs or bristles. The third dorsal abdominal segment before the apex is provided on each side with a large white spot.

Length of body, 9 mm.; of pronotum, 1.5 mm.; of tegmina, 4-5.25 mm.; of wings when present 19 mm.; of hind femora, 7 mm.; of ovipositor, 4.5 mm.

*Habitat*.—Two females, one macropterous, the other brachypterous, coming from Don Diego (100 ft. above sea level), Dept. of Magdalena, Colombia, were collected by H. H. Smith.

Whether or not the present species has the aquatic habits described in connection with the following one, the writer cannot say.

26. *Nemobius aquaticus* sp. nov.

Very closely related to the preceding species both in size and color, but differing from it in never being macropterous so far as the material at hand would indicate. It also differs from *meridionalis* in having longer and heavier posterior femora, in being more robust, in having a heavier ovipositor, which is very gently bent downwards, instead of with a similar upward apical curve, as in the type of that species. It possibly is only a form of *meridionalis*.

Length of body, ♂, 9.5 mm.; ♀, 10.5 mm.; of pronotum, ♂, 1.75 mm., ♀, 2 mm.; width of same, ♂, 2.9 mm., ♀, 3 mm.; length of tegmina, ♂ and ♀, 6 mm.; of hind femora, ♂, 7 mm., ♀, 8 mm.; of ovipositor, 4.5 mm.

*Habitat*.—Very abundant among the floating aquatic plants growing in the Rio de la Plata and along its margins in pools at Buenos Ayres where it was collected during the summer of 1898. It had the habit of very commonly diving below the surface when pursued, and remained hidden among the floating plants for several minutes at a time before again venturing into the air to jump and run about on the stems and leaves of the aquatic plants, which afforded it protection. It also readily took to the open water and swam freely, as if this were a regular pastime.

27. *Nemobius longipennis* Saussure.

*Nemobius longipennis* SAUSSURE, Miss. Mex., Orth. (1874), p. 383; KIRBY, Syn. Cat. Orth., II (1906), p. 20.

*Habitat*.—A number of specimens of a rather large macropterous *Nemobius* in the material now being reported upon are referred to *longipennis* of Saussure. This reference has been made after a comparison with several specimens obtained in Argentina, which appear definitely to be Saussure's species. The material at hand comes from the following localities: Puerto Suarez, 150 M., Santa Cruz de la Sierra, 450 M., and Provincia del Sara, Bolivia, 450 M. (J. Steinbach); Corumbá, lowland, March, and Rio San Laurengo near Corumbá

(H. H. Smith); and lastly Moro do Pará, Rio S. Francisco, Bahia, Brazil, Dec. 6, 1907 (Haseman).

As is the case with some of the other *Nemobii* this species also varies somewhat in both color and size.

28. ***Nemobius brasiliensis*** (Walker).

*Argizala brasiliensis* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 61.

*Nemobius brasiliensis* SAUSSURE, Mém. Soc. Genève. XXV (1877), p. 87; KIRBY,

Syn. Cat. Orth., II (1906), p. 19.

*Nemobius (Argizala) brasiliensis* HEBARD, Proc. Acad. Nat. Sci. Philad., 1913, pp. 403, 446-449, figs. 17, 18.

*Habitat*.—Specimens of this magnificent species are at hand from Rio Paraguay and Concepción, Paraguay, Santa Cruz de la Sierra, Province del Sara, and Puerto Suarez, Bolivia. Most of these were taken by J. Steinbach. They vary somewhat in color and also in size, but all readily run to this species as given in the synoptic key by Hebard, *l. c.*, p. 403.

There is a single additional male at hand from Corumbá, Brazil, which I believe also belongs with this species, although it is rather more robust and lacks the hind wings. In size and a few of its other general characteristics it does not differ greatly, but in color it is of a darker hue, and it also lacks much of the coating of strong bristles on the head and pronotum, so characteristic of *brasiliensis*, though these might have been rubbed off, thus giving to it a smoother appearance. At first I was inclined to refer it to *N. major* of Saussure, but, since this last named insect is said to resemble the *N. fasciatus* De-Geer, I have decided that it can hardly be Saussure's species. Presumably when a sufficient series of specimens of *Nemobius* are at hand from the various South American countries the relationships of these varied forms can better be determined.

29. ***Nemobius argentinus*** sp. nov.

Very closely related to *N. brasiliensis* Walker, with which it agrees in most of its characteristics both as to color and large size. The main difference, however, is in its much shorter and more robust ovipositor. Length of body, ♂, 10 mm., ♀, 12 mm.; of pronotum, ♂, 1.6 mm., ♀, 1.9 mm.; of tegmina, ♂, 6 mm., ♀, 7 mm.; of wings, ♂, 14 mm., ♀, 16 mm.; of hind femora, ♂ and ♀, 7 mm.; of ovipositor, 4.35 mm.



*Habitat*.—The types, ♂ and ♀, come from Carcaraña, Argentina. A number of other specimens were taken at the same place. It was also attracted to lights at Rosario, about thirty miles east of Carcaraña.

This insect very likely is aquatic, as is the species *aquaticus*, described on a preceding page in the present paper.

### 30. *Nemobius cubensis* Saussure.

*Nemobius cubensis* SAUSSURE, Miss. Mex., Orth. (1874), p. 384, pl. 7, fig. 5; Biol. Cent.-Amer., Orth., I (1897), p. 222; SCUDDER, Journ. N. Y. Ent. Soc., IV (1896), p. 105; BLATCHLEY, Rep. Indiana Dept. Geol., XXVII (1903), pp. 420, 425.

*Nemobius (Neonemobius) cubensis* HEBARD, Proc. Acad. Nat. Sci. Philad., 1913, pp. 403, 455-468, figs. 22-24.

For additional synonymy see Hebard, *l. c.*

*Habitat*.—Specimens of what are determined as this species are at hand from the following localities: Los Indios, Isle of Pines, W. Ind., 1 ♀, taken during 1912 by G. Link; Don Diego (100 ft.) Dept. Magdalena, Colombia, S. A. (H. H. Smith) 1 ♀; a single ♂ from Piedra Blanca, Brazil, in April (H. H. Smith); 1 ♂, 3 ♀♀, Puerto Suarez, Bolivia, 150 M., 1 ♂, Santa Cruz de la Sierra, Bolivia, 450 M. and 1 ♂ and 2 ♀♀ Province del Sara, Bolivia, 350 M. (J. Steinbach). One of these latter was taken in December, 1912.

The above localities would indicate a fairly extended distribution for the species in South America as well as for North America as shown in Hebard's paper referred to above. The specimens examined in the series now at hand also show considerable variation in size and some little in structure as well.

### 31. *Nemobius* sp.?

There is a single male specimen before me from Chapada, Brazil, which appears to be distinct from *N. cubensis*, but I hesitate to refer to it as a distinct species with a separate name. Like two or three other specimens of *Nemobius* referred to in the present report this individual lacks hind wings, hence may not be typical of the species to which it belongs. It was collected during July by H. H. Smith.

### 32. *Nemobius chapadensis* sp. nov.

A very dark-colored rather small-sized and slender insect, in which the distoventral spurs of the hind tibiae are of slightly unequal length.

Apparently without hind wings and with the tegmina of the female about three-fourths of, and of the male equal to, the abdomen in length. Ovipositor robust, a little shorter than the hind femora, with a gentle upward curve, the apex having the superior margin not obliquely subtruncate, rather sharply serrate, the immediate apex not very finely pointed.

General color dark piceous varied on the occiput, genæ, legs, humeral angle of tegmina, and venter with some streaks and patches of dull testaceous, most apparent in the male. Front and pronotum provided with a number of moderately strong spine-like black bristles. Head a little wider than the anterior margin of the pronotum; eyes large and prominent, the front and occiput evenly, but not greatly, convex. Pronotum considerably wider than long, the sides gently rounded, the apex but little narrower than the base; the hind margin straight (♂) or a little sinuose (♀).

Length of body, ♂, 5.7 mm., ♀, 7.25 mm.; of pronotum, ♂, 1.15 mm., ♀, 1.35 mm.; width of pronotum, ♂, 2 mm., ♀, 2.25 mm.; length of tegmina, ♂, 4 mm., ♀, 3.5 mm.; of hind femora, ♂ and ♀, 5.5 mm.; of ovipositor, 4 mm.

*Habitat*.—The pair of insects upon which the present species is based come from "Chapada, May" (♀) and "Chapada, near Cuyabá, Matto Grosso, Brazil, June" (♂) where they were taken by H. H. Smith. They belong to the Carnegie Museum.

### 33. *Nemobius amazonus* sp. nov.

A small smooth-bodied insect, which at first glance recalls one of the smaller species of *Miogryllus* in its general appearance, but upon closer inspection shows its Nemobine relationships. It also shows some relationship to *Hygronemobius* in the venation of the tegmina of the male, but has the four movable spines on the two lateral canthi of the hind tibiæ of *Nemobius*.

Head small, about equal in width (♀) or slightly more (♂) than the anterior portion of the pronotum. Eyes of moderate size and prominence, the front gently convex, in the two sexes about equal in width to the longest diameter of one of the eyes. Pronotum a little wider than long, with the sides gently rounded, the hind and front edges about equal in width (♀), or about one and two-thirds wider than long, with the sides divergent towards the base (♂), in both

sexes with a prominent longitudinal depressed line. Tegmina of male almost, those of female about two-thirds, the length of the abdomen. Wings lengthily caudate, fully twice the length of the tegmina, pallid. Hind femora about normal, neither excessively robust, nor noticeably slender. Hind tibiae armed with four movable spines on each margin, these spines only moderately hirsute, the basal ones rather small, the others gradually increasing in length. Ovipositor moderately robust, very gently upwardly curved, the superior margin of its apex rather coarsely toothed. Cerci rather robust, in the female about twice the length of the ovipositor.

Color of head and pronotum black, tegmina and legs fuscous varied with testaceous; the hind femora with two well-defined pallid spots on their upper edge, underside pallid, the apical joints of the palpi dirty white.

Length of body, ♂, 6 mm., ♀, 7.75 mm.; of pronotum, ♂, ♀, 1.25 mm.; width of pronotum, ♂, 2.3 mm., ♀, 1.75 mm.; length of tegmina, ♂, 4.5 mm., ♀, 4 mm.; of wings, ♂ and ♀, 9 mm.; of hind femora, ♂ and ♀, 4.15 mm.; of ovipositor 3 mm.

*Habitat*.—The types, a male and a female, come from Santarem, Brazil (H. H. Smith). They are the property of the Carnegie Museum.

#### Genus HYGRONEMOBIUS Hebard.

*Hygronemobius* HEBARD, Ent. News, XXIV (1913), p. 451; Ent. News, XXVI (1915), pp. 193-199, Pl. VI.

The representatives of this genus appear to be confined to the tropical and subtropical portions of the Americas. Heretofore five species have been recognized, and now a sixth is added. They differ from representatives of the genus *Nemobius* as indicated by the generic synopsis of the Nemobiidæ given on a previous page. The six species may be separated by the following key:

#### SYNOPSIS OF THE SPECIES OF HYGRONEMOBIUS.

- A. Size large (10 mm.). Tegmina of female about one-half the length of the abdomen; hind wings caudate. [Pará].....*basalis* Walker.
- AA. Size small or medium (7.5 mm. or less). Tegmina of female variable, but generally minute, lateral; hind wings either wanting or caudate.
  - b. Form compact, head and pronotum stout, wings absent.
  - c. Maxillary palpi dark. General color dark brown, maculate with a still darker shade.
  - d. Dorso-internal spur of the hind tibiae equalling the metatarsus in

- length. Tegmina of male covering two-thirds of the abdomen, of female minute, lateral pads almost concealed by the pronotum. Ovipositor with the dorsal margin of its apex finely serrulate. [Bahamas, Florida].....*alleni* Morse.
- dd. Dorso-internal spur of the hind tibiae reaching four-fifths of the distance to the apex of the metatarsus. Tegmina of male covering all but the extreme apex of the abdomen, of female very small lateral pads. Ovipositor with the apex unarmed. [British Guiana].....*liura* Hebard.
- cc. Maxillary palpi white.
- d. Male, 5.5-6 mm.; female 7.5 mm. Apex of the last joint of the maxillary palpi broadly, and ventral margin of same narrowly, marked with black. Tegmina of male covering two-thirds of the abdomen, their apex sharply and transversely truncate, tegmina of female squamiform, lateral. Dorso-internal spur of the hind tibiae about three-fourths as long as the metatarsus. [Brazil; Galapagos].....*dissimilis* Saussure.
- dd. (Male, 4.75 mm., female, 5.5 mm.) Tip of the apical joint of the maxillary palpi white. Tegmina of male about one-half the length of the abdomen, their apex broadly rounded; tegmina of female squamiform, lateral. Dorso-internal claw of hind tibiae reaching almost four-fifths the distance to apex of metatarsus. [Brazil].  
*minutipennis* sp. nov.
- bb. Form slender, the head and pronotum proportionately small; wings very long. Maxillary palpi white. Dorso-internal tibial spur reaching two-thirds of the distance to the apex of the metatarsus, these members all very delicate. Tegmina about one-half the length of the abdomen. (Length of body, male and female 5-5.4 mm.) [British Guiana and Brazil].  
*albipalpus* Saussure.

#### 34. *Hygronemobius minutipennis* sp. nov.

Size small, the form compact, or robust. Maxillary palpi rather large, entirely whitish, the terminal segment well expanded apically. Pronotum of the male as in this sex of *dissimilis*, that of the female proportionately longer. Tegmina of the male about one-half the length of the abdomen, broadly rounded at apex, the veining very similar to that of these members in *H. liura* Hebard. Wings absent. The tegmina of the female small, lateral, having their apical edge strongly and obliquely truncate, on their costal margin reaching to the apex of the second abdominal segment. Spines of the hind tibiae robust, rather long, slightly alternating on opposite margins; the inner superior spur reaching between three-fourths and four-fifths of the distance to the apex of the metatarsus. Ovipositor with its

apex on both margins without teeth. General color as in *dissimilis*, *i. e.*, dark brown varied with paler patches, blotches, and specks; the legs, especially the tibiae and tarsi testaceous, annulated with dark brown and piceous.

Length of body, ♂, 4.5 mm., ♀, 5.2 mm.

*Habitat*.—The types, a male and a female, are labelled "Piedra Blanca" and "April," as are three other specimens, a male and two nymphs. There is, however, an additional very imperfect male which was taken at Corumbá, Brazil. All of the specimens were collected by H. H. Smith. These insects are the property of the Carnegie Museum.

### 35. *Hygronemobius albipalpus* (Saussure).

*Nemobius albipalpus* SAUSSURE, Melang. Orth., II (1877), Fasc. V, p. 257; Mém.

Soc. Genève, XXV (1877), p. 89; KIRBY, Syn. Cat. Orth., II (1906), p. 19.

*Hygronemobius albipalpus* HEBARD, Ent. News, XXVI (1915), p. 198, pl. VI, figs. 4, 4A, 4B.

*Habitat*.—There are two females of this species among the material collected by H. H. Smith at Santarem, Brazil. They agree well with Saussure's characterization of the species.

### Genus HEMIGRYLLUS Saussure.

*Hemigryllus* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 100; KIRBY, Syn. Cat. Orth., II (1906), p. 20.

This genus seems to be monotypic and is confined to South America, where it is not at all rare, if we are to judge from the material at hand. It also has a fairly extended distribution.

### 36. *Hemigryllus krieckbaumeri* Saussure.

*Hemigryllus krieckbaumeri* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 101, pl. 12 (viii), figs. 1-6.

*Habitat*.—Originally described from Brazil. There are now before me specimens coming from the following localities: Pará, July (H. H. Smith); Santa Anna, Rio São Francisco, Bahia, Brazil, Dec. 1, 1907 (Haseman); Isla de Carropote in Rio São Francisco, 150 miles from Joazeiro, Bahia, Brazil, Dec. 3, 1907 (J. D. Haseman); and Santa Cruz de la Sierra, Bolivia, 450 M.; Las Juntas, Dept. Santa Cruz, Bolivia, 250 M.; and Province del Sara, Bolivia, 350 M., Feb., Oct., Dec. (J. Steinbach).



## SYNOPSIS OF THE SOUTH AMERICAN GENERA OF ACHETIDÆ.

- A. Posterior tibiæ with the inner upper spur distinctly longer than the middle one. Ocelli arranged in a triangle. Ovipositor rudimentary.  
*Anurogryllus* Saussure.
- AA. Posterior tibiæ with the inner upper spur of equal length or shorter than the middle one. Ocelli variable. Ovipositor not rudimentary, fully developed.
- b. Anterior tibiæ furnished with auditory openings on both margins; the external one larger and oblong, the internal smaller, circular.
- c. Species larger. Tegmina of the female with the dorsal areoles rhomboidal, in the male the tympanum is provided with three to four oblique veins.
- d. Ocelli placed in a transverse row. Body, pronotum, and limbs comparatively smooth, almost bare. Lateral lobes of the pronotum nearly quadrate. [Chiefly Old World forms.] *Acheta* Fabricius.
- dd. Ocelli placed in a triangle. Body, pronotum, and limbs hirsute or pilose. Lateral lobes of the pronotum more or less strongly oblique. [Distribution quite general].....*Gryllus* Linnaeus.
- cc. Species smaller. Tegmina of the female with the dorsal areoles quadrate; in the male the tympanum is sometimes provided with two oblique veins.....*Miogryllus* Saussure.
- bb. Anterior tibiæ without an auditory opening internally. The tegmina frequently greatly abbreviated.....*Gryllodes* Saussure.

## Genus ANUROGYLLUS Saussure.

*Anurogryllus* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 283; KIRBY, Syn. Cat. Orth., II (1906), p. 23.

This is exclusively an American genus, unless we include the *A. australis*, which is credited to Australia, and its representatives are confined to the tropical and subtropical portions of both North and South American countries. According to Kirby's Catalog there are an even half dozen species. The females are noted for the entire absence, or great abbreviation, of the ovipositor. The males, if we are to judge from the single species known quite well to the author, *A. clarazianus* Saussure, are among the noisiest of the crickets. Only a single species is recognized among the material at hand.

37. *Anurogryllus clarazianus* (Saussure).

*Gryllodes clarazianus* SAUSSURE, Miss. Mex., Orth. (1874), p. 412, Pl. 8, fig. 31.

*Anurogryllus clarazianus* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 285; KIRBY, Syn. Cat. Orth., II (1906), p. 24.

*Habitat*.—Chapada near Cuyabá, Matto Grosso, Brazil, one male taken in March (H. H. Smith); Prov. del Sara, Bolivia, 350 M. and 450 M. December (J. Steinbach), two males, two females.

This species occurs in both brachypterous and apterous individuals so far as the hind pair is concerned. When provided with wings these organs nearly always are fully developed and lengthily caudate. Possibly all are winged at first, but lose them later in combat or by accident. These crickets dwell in perpendicular burrows of several inches in depth which they evidently construct for themselves. At Carcaraña, Argentina, they were collected just before dusk when the males were readily located by the loud and continued shrilling they made as they sat at the mouths of their burrows.

#### Genus *ACHETA* Fabricius.

*Gryllus Acheta* LINNÆUS, Syst. Nat. (ed. X), I (1758), p. 428.

*Acheta* FABRICIUS, Syst. Ent. (1775), p. 279; KIRBY, Syn. Cat. Orth., II (1906), p. 24.

For additional synonymy see Kirby, *l. c.*

While the present genus belongs to the Old World, at least one of the species, *A. bimaculata* DeGeer, is known to be almost or quite generally distributed over the entire oriental region as well as in portions of the New World, whither it has been carried by commerce. No representatives of this insect are at hand, but the present writer remembers having seen specimens in one or more South American collections, which were labeled as coming from the immediate vicinity. As memory serves, the collections containing such specimens were in Rio de Janeiro and Buenos Aires.

#### Genus *GRYLLUS* Linnæus.

*Gryllus* LINNÆUS, Syst. Nat., Ed. X (1758), p. 425; and most entomological writers since, especially SAUSSURE, Miss. Mex., Orth. (1874), p. 391; Mém. Soc. Genève. XXV (1877), p. 144 for S. American forms.

*Acheta* FABRICIUS (in part), Syst. Ent. (1775), p. 279.

Representatives of the genus *Gryllus* occur throughout the temperate and tropical countries and islands of the earth. According to Kirby (see Syn. Cat. Orth. II, pp. 27-38) one hundred and ten distinct species are recognized. These insects are usually moderately large and dark-colored. They live for the most part on the ground, in which they burrow, or crawl beneath stones, sticks, pieces of bark, boards, chips, and other protecting objects. Usually these insects live in pairs, but sometimes singly, or at other times socially. A few of the North American forms have been considered agricultural pests, since

they have the habit of gathering in grain shocks where they have been known to gnaw the bands of twine which hold the individual sheafs of grain together and thus render its handling difficult and more expensive.

The characters used for the separation of the various species are such as size, length of wing, length of ovipositor, comparative size and form of head and pronotum, and the size and form of the hind femora, together with the venation of the tegmina of the males.

About eighteen species have been recorded from the Antilles and South American countries. Only a very small proportion of these seem to be represented by the material now being reported upon. No synoptical key for the separation of the South American forms will be given on that account, but the reader is referred to the special papers of Saussure above cited.

### 38. *Gryllus abbreviatus* Serville.

*Gryllus abbreviatus* SERVILLE, Ins. Orth. (1839), p. 335; SCUDDER, Bost. Journ. Nat. Hist., VII (1862), p. 427; GLOVER, Ill. N. A. Orth. (1872), Pl. 9, figs. 10, 11; SAUSSURE, Miss. Mex., Orth. (1874), p. 400; Mém. Soc. Genève, XXV (1877), p. 149; and others.

For synonymy see Kirby, Syn. Cat. Orth., II (1906), p. 35.

*Habitat*.—There seems to be a female of the present species at hand from the Island of Jamaica, W. I. It belongs to the Carnegie Museum Accession No. 2306.

Three other short-winged crickets are among the material now being studied. Two of these, male and female, come from Chapada and Pará, Brazil (H. H. Smith), and the other, a female, from the Province del Sara, Bolivia, 350 M. (J. Steinbach), October, 1913. However, these latter have the ovipositor but 15 mm. long, and may be brachypterous specimens of *G. assimilis*.

I may add that the present status of our knowledge of the American species of this genus is rather vague. We know but little concerning the amount of variation in size, color, form of head, pronotum, length of wing and ovipositor which may be found to exist in these insects. In order to reach satisfactory conclusions a very large series of specimens is necessary from a wide extent of territory. The habits also of the living insects should be considered when such a study is taken up.

39. *Gryllus argentinus* Saussure.

*Gryllus argentinus* SAUSSURE, Miss. Mex. (1874), p. 399; Mém. Soc. Genève, XXV (1877), p. 152; KIRBY, Syn. Cat. Orth., II (1906), p. 37.

*Habitat.*—There is a single male specimen of a *Gryllus* at hand, which I refer to this species. It comes from Tucuman, Argentina, where it was taken October 19, 1912, by W. J. Holland. A female from the Province del Sara, Bolivia, may also belong here. It is quite pale in its general color.

This species is also reported to occur in Paraguay and Brazil. In fact, there are three female specimens in the present collection from Pará, which I have so labeled, although with some doubt as to the correctness of the determination. The length of the ovipositor (14–15 mm.) seems to agree better with the measurements given for *assimilis*.

40. *Gryllus assimilis* Fabricius.

*Gryllus assimilis* FABRICIUS, Syst. Ent. (1775), p. 280; OLIVER, Encl. Meth., VI (1791), p. 634; BURMEISTER, Handb. Ent., II (1838), p. 733; SAUSSURE, Miss. Mex. (1874), p. 396, Pl. 8, figs. 27–29; Mém. Soc. Genève, XXV (1877), p. 150, Biol. Cent.-Amer., Orth. I (1897), p. 226, Pl. II, fig. 20.

For further synonymy see Kirby, Syn. Cat. Orth., II, p. 37.

*Habitat.*—This is without doubt the most abundant and widely distributed species of the genus in tropical America. It is known to occur in most of Mexico, in Central America, in the West Indies, and in South America to Bolivia, Paraguay, and northern Argentina. Specimens are at hand from Cuba and the Isle of Pines, West Indies, Bahia, Brazil, and from Puerto Suarez, Sta. Cruz de la Sierra and Province del Sara, Bolivia.

Genus *MIOGRYLLUS* Saussure.

*Miogryllus* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 194; Biol. Cent.-Amer., Orth. I (1897), p. 227; SCUDDER, Psyche, IX (1901), p. 256; KIRBY, Syn. Cat. Orth. I (1906), p. 38.

The representatives of the present genus are American and are to be found in the countries of North and South America between the fortieth parallels of latitude. At least a dozen species have been recognized and described, fully half of which belong to, or probably occur in, the region of which this paper treats.

Owing to the different characters used by authors in their descriptions, it seems rather difficult to make a practical synoptical key for

their ready separation. Hence none will be attempted at this time. These small crickets very likely agree fairly well with the members of *Gryllodes* and *Gryllus* in their haunts and habits.

The following listed species appear to be represented among the material at hand.

41. *Miogryllus pusillus* (Burmeister).

*Gryllus pusillus* BURMEISTER, Handb. Ent., II (1838), p. 733; SAUSSURE, Mém.

Soc. Genève, XXV (1877), p. 194; Pl. 12 (XI), figs. 7, 7e, f.

*Gryllodes pusillus* SAUSSURE, Miss. Mex., Orth. (1874), p. 416, Pl. 7, fig. 6.

*Miogryllus pusillus* SAUSSURE, Biol. Cent.-Amer., Orth., I (1897), p. 227; KIRBY, Syn. Cat. Orth. II (1906), p. 38.

*Habitat*.—There are two males and one female in the collection made by H. H. Smith at Santarem, Brazil. I also find another male bearing the label "Chapada, Brazil, Acc. No. 2966." This last insect was taken in October. The species is also recorded from Mexico, Guiana, Peru, etc., showing a rather wide distribution.

42. *Miogryllus micromegas* (Saussure).

*Gryllodes micromegas* SAUSSURE, Miss. Mex., Orth. (1874), p. 418.

*Gryllus micromegas* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 196.

*Miogryllus micromegas* SAUSSURE, Biol. Cent.-Amer., I (1897), p. 227; KIRBY, Syn. Cat. Orth., II (1906), p. 39.

*Habitat*.—Two females of still another species of this genus are referred here. One of them comes from "Bom Jesus de Lapa, Rio São Francisco, Brazil," where it was taken Dec. 8, 1907, by Haseman. The other is labeled "Prov. del Sara, Bolivia, 350 M. J. Steinbach, II, 1913."

43. *Miogryllus brevipennis* (Saussure).

*Gryllodes brevipennis* SAUSSURE, Miss. Mex., Orth. (1874), p. 418.

*Gryllus brevipennis* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 195.

*Miogryllus brevipennis* SAUSSURE, Biol. Cent.-Amer., Orth. I (1897), p. 227; KIRBY, Syn. Cat. Orth., II (1906), p. 39.

*Habitat*.—I find a pair of these little crickets which I place with Saussure's *M. brevipennis*. They come from Santa Cruz de la Sierra, Bolivia, at an altitude of 450 meters above sea-level, and were taken by J. Steinbach. They belong to Accession No. 4546.

These little crickets resemble representatives of the genus *Gryllodes*, but have both sides of the anterior tibia perforated, a character belonging to *Miogryllus*.



## Genus GRYLLODES Saussure.

*Grylloides* SAUSSURE, Miss. Mex., Orth. (1874), p. 409; Mém. Soc. Genève, XXV (1877), p. 197; Biol. Cent.-Amer., Orth. I (1897), p. 228; etc.

As indicated in the Synopsis of Genera of South American Achetidæ, the representatives of the genus *Grylloides* differ from those of other genera chiefly in the absence of an auditory opening on the inner margin of the front tibiæ. Most of the species also have greatly abbreviated tegmina and wings, especially in the females. They are rather solitary in habit and live both in shallow burrows or beneath stones, chips, pieces of bark, sticks, etc., preferring open, moderately dry, or well drained slopes to flat, damp localities. Ten or a dozen species have been recorded from the region embraced in the present paper. Representatives of but four of these are at hand.

44. *Grylloides sigillatus* Walker.

*Gryllus sigillatus* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 46.

*Grylloides sigillatus* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 210.

*Gryllus pustulipes* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 51.

*Grylloides pustulipes* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 210.

*Grylloides poeyi* SAUSSURE, Miss. Mex., Orth. (1874), p. 420, pl. 7, fig. 8; Mém. Soc. Genève, XXV (1877), p. 219.

*Habitat*.—A pair of this species are before me, which were taken at Los Indios, Isle of Pines (G. Link, collector). It has also been recorded from most of the other West Indian islands, a number of Mexican, Central and South American localities, the Hawaiian Islands, Australia, and some of the East Indian islands as well. It is evidently a species of the sea coast which has been spread by means of commerce and drifting vegetation.

45. *Grylloides parvipennis* Saussure.

*Grylloides parvipennis* SAUSSURE, Miss. Mex., Orth. (1874), p. 419; Mém. Soc. Genève, XXV (1877), p. 216; KIRBY, Syn. Cat. Orth., II (1906), p. 43.

*Habitat*.—Two female specimens are referred here. One comes from Santarem, Brazil (H. H. Smith), the other bears no locality-label, but is dated July. It was probably taken by the same collector and at the same place.

46. *Grylloides macropterus* sp. nov.

About the same in size and general color as *G. laplatæ* Saussure, but with fully developed tegmina and excessively elongated wings and

ovipositor, the latter extending somewhat beyond the apex of the hind legs when fully straightened out. Wings only a little shorter.

Form moderately robust, somewhat resembling a small *Gryllus* in general appearance, but lacking the perforation on the inner side of the anterior tibiæ, and having the areoles of the dorsal portion of the tegmina in the female quadrate, instead of rhomboidal, as in *Acheta* and *Gryllus*. Head shining black, moderately large, subrotund, of about the same width as the anterior edge of the pronotum. Front about twice the shorter diameter of one of the eyes, the latter not prominent, a little elongate up and down; the ocelli arranged in an arcuate line, the lateral ones rather large and prominent. Front provided with an inverted broadly Y-shaped testaceous marking, the upper extremity of the shank of which reaches a point on a level with the center of the base of the antennæ. Occiput provided with six prominent testaceous lines. Genæ and mouth-parts pallid, the palpi dirty white, or pale testaceous. Pronotum somewhat pubescent, nearly twice as broad as long, the sides gently rounded, the anterior margin widely and evenly emarginate, the hind margin somewhat sinuose; the disk dark brown and rather prominently varied with testaceous, the lateral lobes having the superior portion piceous, the inferior portion pallid. Tegmina complete, almost reaching the apex of the abdomen, the humeral angle and the costal area pallid, the remainder fuscobrunneous. Legs testaceous, the hind femora embrowned. Wings pallid, lengthily caudate, extending fully three-fifths of their length beyond the tip of the tegmina. Ovipositor slender, filiform, excessively long.

Length of body, ♀, 12 mm.; length of pronotum, 2.5 mm., width, 4.5 mm.; length of tegmina, 8 mm., of wings, 20.5 mm., of hind femora, 10 mm., of ovipositor, 15 mm.

*Habitat*.—The type, a female, and the only specimen at hand, comes from Bahia, Brazil, west of Jacobina on road to Catinga, Nov. 10, 1907 (Haseman). It is in the Carnegie Museum.

#### 47. *Gryllodes argentinus* sp. nov.

The present writer possesses a male and three females of another macropterous *Gryllodes* which were taken at Carcaraña, Argentina. These insects are slightly larger and a little more robust than the female *G. macropterus* just described. They are also somewhat darker-

colored and lack much of the testaceous maculation of that species. The ovipositor is shorter and the wings somewhat less caudate.

Length of body, ♂ and ♀, 14 mm.; of pronotum, ♂, 2.25 mm., ♀, 2.50 mm., width, 4.5 mm.; length of tegmina, ♂ and ♀, 8 mm.; length of wings, ♂, 19 mm., ♀, 20 mm.; of hind femora, ♂, 8.5 mm., ♀, 9.75 mm.; of ovipositor, 10.5 mm.

*Habitat*.—As stated above, these insects come from Carcaraña, Argentina, where they were taken at lights.

#### 48. *Grylloides laplatæ* Saussure.

*Gryllus laplatæ* SAUSSURE, Miss. Mex., Orth. (1874), p. 408.

*Grylloides laplatæ* SAUSSURE, Mém. Soc. Genève, XXV (1877), p. 215; KIRBY, Syn. Cat. Orth., II (1906), p. 43.

*Habitat*.—There are several specimens of this insect at hand in the present writer's collection from both Rosario and Carcaraña, Argentina.

Possibly this and the two preceding are representatives of a single very variable species, which has a wide distribution over South America. The present form and *G. argentinus* described here agree in length of ovipositor.

#### Family GRYLLOMORPHIDÆ.

The insects, which have been relegated to the present family, occur chiefly in the Orient. Two genera, however, have representatives in South American countries. *Odontogryllus* with two species from Peru and Ecuador and *Zoara* with a single species from Jamaica. None of these appear to be among the specimens now being reported upon.

#### Family MYRMECOPHILIDÆ.

The crickets which comprise this family are found fairly well-distributed over the temperate and subtropical countries of the earth. They very likely also occur in the tropics, but thus far have not been collected. These insects are all small, some of them even minute, wingless, and quite delicate in structure. As the name implies, they live with ants, in the nests of which they are to be looked for.

The material at hand does not contain any representatives of the family, and so far as the present writer is aware, but a single species, *Myrmecophila americana* Saussure from Colombia is recorded as occur-

ring in South American territory. However, if we may judge by the numbers of species and the diversity of form and habits characterizing the ants belonging to the neotropical fauna, we most assuredly have a right to surmise that at least several additional species of *Myrmecophila* will ultimately be found in other portions of South America.

#### Family MOGOPLISTIDÆ.

The representatives of the family of Mogoplistidæ are all rather small crickets, which have their bodies more or less clothed with scales. These insects are widely spread over the warmer countries of the globe. Already eleven genera are known and upwards of fifty species. The group so far as North American territory is concerned has comparatively recently been carefully studied by Messrs. James A. G. Rehn and Morgan Hebard (*see* Proc. Acad. Nat. Sci. Philad., 1912, pp. 184-234, figs. 1-28).

A single native specimen of the family is at hand.

#### 49. *Cryptoptilum antillarum* (Redtenbacher).

For a very full synonymy of the species see Rehn and Hebard, *l. c.*, pp. 196-201, figs. 5-8.

*Habitat*.—A ♀ from Blue Hills, Nassau, Bahamas (W. W. Worthington). This insect was taken in January, 1909.

In addition to the above recorded insect there is a very imperfect nymph before me from "20 miles east of Bom Jesus da Lapa, Bahia, Brazil" where it was taken December 8, 1907, by Haseman. It is further marked by the Carnegie Museum Accession No. 3765.

#### Family PENTACENTRIDÆ.

The small family Pentacentridæ, so far as known, is represented in America only by a single genus and one species, viz., *Nemobiopsis gundlachi* Bolívar, from the island of Cuba. This family is characterized as shown in the synopsis of families on a preceding page. The material at hand for study does not contain representatives of the group.

#### Family PHALANGOPSITIDÆ.

This is an extensive family composed of numerous genera, the representatives of which are distributed over the warmer countries of the earth. A dozen or more of the genera have representatives in

South American regions. They may be separated by the subjoined key:

SYNOPSIS OF THE SOUTH AMERICAN GENERA OF PHALANGOPSITIDÆ.

- A. Pronotum wider than long, its lateral lobes quadrate, or rounded, or even angulated, but not narrowed in front.
  - b. Lateral lobes of the pronotum quadrate, the lower margin horizontal. Front between the antennæ broad, not rostrate, the posterior ocelli distant from each other. Hind femora somewhat shortened, the apex not slender.
    - c. Tegmina of the male fully developed, the tympanum complete, the speculum triangular, divided by two veins. Pronotum with the lateral lobes distinctly quadrate.
      - d. Anterior tibiæ with an auditory opening on each side. The median vein of the tegmina branched.....*Lerneca* Walker.
      - dd. Anterior tibiæ with an auditory opening only on the inner side. Tegmina with the median vein not branched, simple.
        - Prosthacusta* Saussure.
    - b. Lateral lobes of the pronotum oblique, rounded or angulate, the lower margin ascending towards the rear. Front between the antennæ narrow, sometimes narrowly rostrate.
      - c. Hind femora mediocre, gradually attenuated, the apical portion somewhat heavy, not filiform.
        - d. Anterior tibiæ without an auditory opening. Body of the female apterous (male also without wings).....*Laranda* Walker.
        - dd. Anterior tibiæ with distinct auditory openings. Tegmina of male with the speculum divided by many veins.
          - e. Rostrum of the front very narrow; the posterior ocelli rather close together. Anterior tibiæ with openings on both sides (sometimes almost closed externally). Posterior metatarsus carinate, uniseriately serrate. (Upper inner spur of the hind tibiæ deformed.).....*Paragryllus*<sup>4</sup> Guérin.
          - ee. Rostrum of the front narrow; the posterior ocelli less closely situated. Front tibiæ with the auditory opening on the outer side. Posterior metatarsus sulcate, biseriately serrulate. The spurs normal.....*Ectecous* Saussure.
      - cc. Legs longer. Hind femora swollen at the base, the apex slender.
        - d. Anterior tibiæ provided with auditory openings.
          - e. Rostrum of the front very narrow; the posterior ocelli very near together. (Speculum divided by two veins or triangular, not divided).
          - f. Anterior tibiæ furnished with foramina on both sides.
            - g. Rostrum of the front triangular, the anterior ocellus located on its apex in front. Tegmina corneous, without veins above. Both sexes winged.....*Amusus* Saussure.

<sup>4</sup> *Luzara* Walker also runs here. Whether distinct or not I cannot say.



gg. Rostrum of the front variable, the anterior ocellus located on its apex above. Tegmina of the males membranous, provided with a tympanum. Legs greatly elongate.

h. Posterior tibiæ with two internal spurs almost equal in length. Lateral lobes of the pronotum broadly rounded. Head rounded, the rostrum turned down in front. Female apterous. *Dyscophogryllus* Rehn.

hh. Posterior tibiæ with the upper internal spur much shorter than the median. Lateral lobes of the pronotum more angulate. Front narrowly rostrate. Female apterous. Tegmina of male abbreviated, discoidal. Pronotum arched, the lateral lobes angulated. Posterior femora elongate.

*Amphiacusta* Saussure,

ff. Anterior tibiæ provided with a single auditory opening and this on the inner side.

g. Upper inner spur of the hind tibiæ shorter than the middle one.....*Endacusta* Brunner.

gg. Upper inner spur of the hind tibiæ longer than the middle one.....*Endecous* Saussure.

dd. Anterior tibiæ without auditory openings. Legs very long, spider-like. Anterior femora not serrulate.

e. Upper internal spur of the hind tibiæ of equal length with, or longer than, the median. Tegmina of the male minute, the tympanum rudimentary. Female apterous.

*Phalangopsis* Serville.

ee. Upper internal spur of the hind tibiæ shorter than the middle one.

*Arachnomimus* Saussure.

AA. Pronotum somewhat elongate, its lateral lobes narrowing anteriorly, the lower margin ascending towards the front.....*Cophus* Saussure.

### Genus LARANDA Walker.

*Laranda* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 88; KIRBY, Syn. Cat. Orth. II (1906), p. 64.

*Larandus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 409.

The members of the present genus, so far as we know, are confined to tropical American regions where they live on the ground among fallen leaves and other dead and decaying vegetation. They are moderately large insects, with characters such as are indicated in the synopsis of genera given on a preceding page. Only a comparatively few species are known.

### 50. *Laranda tibialis* Walker.

*Laranda tibialis* WALKER, Cat. Derm. Salt. I (1869), p. 89; KIRBY, l. c. (1906), p. 67.

*Gryllomorpha tibialis* SAUSSURE, Miss. Mex., Orth. (1874), p. 431.

*Larandus tibialis* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 410, Pl. 19 (LXXVII), figs. 1, 1e, i.

*Habitat*.—Two males and a female are at hand. They were taken at Corumbá and Chapada, Brazil, during the months of September and October by H. H. Smith. Carnegie Museum.

Genus PARAGRYLLUS Guérin.

*Paragryllus* GUÉRIN, Icon. Reg. Anim, Ins. (1844), p. 329; SAUSSURE, Miss. Mex., Orth. (1874), p. 441; Mém. Soc. Genève, XXV (1878), p. 411; Biol. Cent. Amer., Orth., I (1897), p. 242; KIRBY, Syn. Cat. Orth., II (1906), p. 64.

This is also a tropical American genus and representatives occur from Mexico to Brazil including the Antilles. No specimens of the genus appear to be among the material before me, unless we can include Walker's *Luzara rufipennis* from Colombia, and an apparently new form from Puerto Suarez, Bolivia, a characterization of which follows:

51. *Luzara rufipennis* Walker?

*Luzara rufipennis* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 103; KIRBY, Syn. Cat. Orth., II (1906), p. 65.

*Habitat*.—There is a single mutilated male specimen at hand from Chapada, Brazil, which is doubtfully referred to Walker's *Luzara rufipennis*. The shape and color of the maxillary palpi and pronotum are somewhat different from what is indicated in Walker's description. Otherwise it agrees well with the several specimens described under the name.

52. *Luzara boliviana* sp. nov.

A moderately large and robust insect for the group. Body glabrous, on the hind femora and abdomen above inclining to tomentose. General color dark piceous, with the occiput, the disc of the pronotum, tegmina, and hind tibiæ deep ferruginous, merging into piceous. Venter and the inner face of the hind tibiæ pallid, inclining to testaceous. Apical and subapical segments of the maxillary palpi large and clear ivory-white, giving to the insect a very striking appearance.

Head somewhat narrower than the anterior portion of the pronotum, the occiput short and evenly rounded, the vertex and front narrowed between the antennæ; the eyes fairly large, but not prominent; the ocelli also quite large, the posterior pair located well forward, the anterior one situated on the upper face of the perpendicular front.

Antennæ slender, of moderate length, the basal segments about equal in diameter to the width of the rostrum between them. Pronotum somewhat transverse, the humeral angles broadly rounded; lateral lobes a little deflexed outwardly anteriorly, the lower margin rising towards the base; front or apex very broadly and shallowly emarginate, the base squarely truncate; the disc provided behind with a rather large, but shallow, >-shaped depression, the apex of which is directed cephalad and also with a median longitudinal line. Tegmina moderately large in the male and covering about three-fifths of the abdomen, in the female lateral and extending but part way across the basal abdominal segment, or entirely missing. Cerci moderately heavy and long, nearly or quite the length of the hind femora. The latter fairly robust and having the apical portion heavy; anterior and middle legs slender, the auditory opening rather large on the inner, but minute on the outer face. Last ventral segment of the abdomen of the male broadly scoop-shaped, upturned; the supra-anal plate subquadrate, the outer apical angles provided with large, slightly outwardly directed tubercles. Ovipositor robust at its base and slender at the apex, gently falcate.

Length of body, ♂, 22 mm., ♀, 23 mm.; of pronotum, ♂ and ♀, 4 mm.; width, ♂ and ♀, 6 mm., length of tegmina, ♂, 10 mm.; ♀, 5.75 mm., width of ♂ tegmina, 8 mm.; length of hind femora, ♂ and ♀, 16.5 mm.; of ovipositor, 13 mm.

*Habitat*.—Three males and two females, Puerto Suarez, Bolivia, 150 M., Nov., 1908–Jan., 1909 (J. Steinbach). The types are in the collection of the Carnegie Museum.

### 53. *Luzara borellii* (Giglio-Tos).

*Ectecous borellii* GIGLIO-TOS, Boll. Mus. Torino, XII (1897), No. 302, p. 44; KIRBY, Syn. Cat. Orth., II (1906), p. 65.

*Habitat*.—There are three specimens, two males and one female, in the collections made by J. Steinbach, which seem to agree with the description of Giglio-Tos' *Ectecous borellii*. It certainly is not this genus and I have referred it to *Luzara* instead. It is in reality quite closely related to the preceding, if the two are not forms of the same species.

### Genus ECTECOUS Saussure.

*Ectecous* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 414; Biol. Cent.-Amer., Orth. I (1897), p. 244; KIRBY, Syn. Cat. Orth., II (1906), p. 65.

The genus *Ectecous* is entirely tropical American in its distribution, and its representatives may be recognized by reference to the synoptic key given on a preceding page.

54. ***Ectecous cantans*** Saussure?

*Ectecous cantans* SAUSSURE, Biol. Cent.-Amer., Orth., I (1897), p. 244, Pl. 12, figs. 8-10; KIRBY, *l. c.*

*Habitat*.—There is a single male specimen at hand which seems to belong here or at least near to it. It bears the label "Muñez Freire, Espirito Santo, Brazil, June 19, 1908.—Haseman."

Genus *DYSCOPHOGRYLLUS* Rehn.

*Dyscophogryllus* REHN, Can. Ent., XXXIII (1901), p. 272; KIRBY, Syn. Cat. Orth., II (1906), p. 66.

*Dyscophus* SAUSSURE (*non* Grandidier), Miss. Mex., Orth. (1874), p. 438; Mém. Soc. Genève, XXV (1878), p. 420.

This genus, like several of the other genera of the family, is entirely tropical American in its distribution. The representatives undoubtedly live largely among rocks in the crevices of and beneath which they find safe retreats from the many natural enemies they must have. Caves are also known to afford them suitable retreats. Only a single representative is at hand in the following apparently undescribed species.

55. ***Dyscophogryllus castaneus*** sp. nov.

A medium-sized, glabrous (♂) or pubescent (♀) reddish brown insect, in which the male is provided with well-developed tegmina, while the female is entirely apterous. About the size of *D. onthophagus* Berg of Uruguay.

Head short, rounded, a little narrower than the apex of the pronotum, the occiput smoothly and evenly rounded, the eyes fairly large and somewhat prominent, the rostrum short, broader than the diameter of the basal antennal segments, ocelli large; the maxillary palpi pale, elongate, the apical segment somewhat expanded and arcuate. Pronotum formed as in members of allied genera, a little wider than long, the anterior edge very shallowly and broadly roundly emarginate, behind straight. Tegmina of male well developed, covering about two-thirds of the abdomen and well provided with veins. Front and middle legs moderately long, the anterior tibiæ with their auditory openings both in front and behind. Hind femora robust,

their apex slender; hind tibiæ strongly serrate and provided with 4 : 4 movable, slightly curved, strong spines. Metatarsus elongate, with serrations on both margins.

Length of body, ♂, 16 mm.; of pronotum, 3 mm.; width, 4.1 mm.; length of tegmina, 7 mm., width, 6 mm.; length of hind femora, 11.5 mm.

*Habitat*.—Rio Sapão, Bahia, Brazil, Jan. 29, 1908 (Haseman). The type is in the Carnegie Museum.

There is also a somewhat mutilated female specimen before me, which belongs to this group. It is quite strongly pubescent and somewhat hirsute, has the apex of the hind femora more robust. It comes from "Bom Fim, Bahia, Brazil, at Fazenda de Amaratu, Nov. 20, 1907" (Haseman). Whether it is of the same species I cannot say, but have so labeled it for the present.

#### Genus AMPHIACUSTA Saussure.

*Amphiacusta* SAUSSURE, Miss. Mex., Orth. (1874), p. 444; KIRBY, Syn. Cat. Orth., II-(1906), p. 67.

*Amphiacustes* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 429; Biol. Cent.-Amer., Orth. I (1897), p. 245.

*Amphiacusta* is another American genus of these crickets. Nine species have been recognized. Two of them seem to be represented in the Carnegie collections now being examined by me.

#### 56. *Amphiacusta annulipes* (Serville).

*Phalangopsis annulipes* SERVILLE, Ann. Sci. Nat., XXII (1831), p. 167; Hist. Orth. (1839), p. 369; BURMEISTER, Handb. Ent., II (1838), p. 722, etc.

For the synonymy of this species see Kirby, Syn. Cat. Orth., II, p. 68.

*Habitat*.—There are two mature specimens and one female nymph at hand. They bear the label "Los Indios, Isle of Pines, W. I., 1912 (W. Link)." They belong to the Carnegie Museum, Accession No. 4798.

#### 57. *Amphiacusta grandis* (Serville)?

*Amphiacusta grandis* SAUSSURE, Miss. Mex., Orth. (1874), p. 447; KIRBY, Syn. Cat. Orth., II (1906), p. 68.

*Amphiacustes grandis* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 431.

*Habitat*.—I have before me a single female specimen coming from Muñez Freire, Espirito Santo, Brazil, which I refer here with some doubt, since the insect was originally described from Cuba. The speci-



men was preserved in spirits and is in a rather poor condition of preservation. It was taken June 19, 1908 (Haseman). It is in the Carnegie Museum.

Genus ENDECOUS Saussure.

*Endecous* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 439; KIRBY, Syn. Cat. Orth., II (1906), p. 70.

This is another of the several American genera of the family Phalangopsitidæ which is represented among the material at hand. Up to the present time only a single species seems to have been described. Now there appears to be a second one to be recorded.

58. *Endecous arachnopsis* Saussure.

*Endecous arachnopsis* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 439; KIRBY, l. c. (1906), p. 70.

*Habitat*.—I find two males and two females of a cricket which appears to be this species. They come from San Matias, Bolivia, where they were collected in a cave on June 8, 1909 by J. D. Haseman.

59. *Endecous ferruginosus* sp. nov.

Somewhat similar to the preceding, but much larger and more robust, with longer cerci. Moderately hirsute throughout. Ferruginous, the underside a little paler, and the eyes mottled with brown. Head short, a little narrower than the anterior margin of the pronotum, the occiput evenly rounded; front between the antennæ about two-thirds the width of the diameter of one of the basal joints of former; ocelli small and inconspicuous. Pronotum wider than long, the lateral lobes moderately high and bent outwards towards the anterior margin, both angles broadly rounded, evenly truncate both at the base and the apex, the disc with several irregular depressions and a median longitudinal line. Tegmina covering about two-thirds of the abdomen, the speculum large and provided with two complete diagonal veins which suddenly bend at a right angle, and follow parallel with the anterior border. Hind femora rather robust, their apical one-fourth slender. Hind tibiæ a little longer than the femora, provided on the outer and inner carinæ with four large movable spines, the upper inner spur shorter than the middle one. Last ventral segment a little longer than wide, narrowly scoop-shaped, with the sides parallel and the apex broadly rounded. Cerci heavy at their base, nearly as long as the hind femora.

Length of body, ♂, 14 mm.; of pronotum, 3 mm.; width, 3.75 mm.; length of tegmina, 6.25 mm., width, 4.5 mm.; length of hind femora, 11.5 mm.

*Habitat*.—"Province del Sara, Bolivia, 350 M., Mch.-April, 1913 (J. Steinbach)," one male. The type is in the Carnegie Museum.

Genus PHALANGOPSIS Serville.

*Phalangopsis* SERVILLE, Ann. Sci. Nat., XXII (1831), p. 166; Ins. Orth. (1839), p. 367; BURMEISTER, Handb. Ent., II (1838), p. 721; SAUSSURE, Miss. Mex., Orth. (1874), p. 451; Mém. Soc. Genève, XXV (1878), p. 440; KIRBY, Syn. Cat. Orth., II (1906), p. 70.

The genus *Phalangopsis* contains insects of rather striking appearance, since they are of medium or large size, and are provided with very long spider-like legs, lack organs of flight, and even those for stridulating purposes. So far as I know, but three species have been described, one oriental, and two from tropical America. Now another American species is to be added.

60. *Phalangopsis marmoratus* sp. nov.

Testaceous to ferrugineo-testaceous, marmorate and banded with fuscous. In the female entirely apterous, in the males provided with short corneous tegmina, which are peculiarly modified by having the dorso-apical margin inflated and glabrous, reminding one of the edges of leaves that have been modified into a gall-like fold by the attacks of some insect. Body sericeous and tomentose. Antennæ annulate with fuscous and pallid.

Size larger than usual, the hind femora moderately robust on their basal half. Legs broadly and regularly annulate with fuscous. Head perpendicular, considerably narrower than the wide pronotum; eyes not prominent, the vertex depressed and forming a narrow rostrum between the rather large basal antennal joints; ocelli not prominent, the anterior one located where the vertical front meets the horizontal rostrum, the posterior ones at the sides of the base of the rostrum. Pronotum large, bulging or convex, broadest towards the front, the lateral lobes highest and dilated over the coxæ of anterior legs, well rounded and ascending to the rear, anterior margin broadly and roundly emarginate, the posterior margin straight. Hind tibiæ a little longer than the femora, the margins finely spined or serrate and provided apically with 4 : 4 elongate movable spines. Metatarsus elongate and provided with two rows of spines above, but not carinate.

Length of body, ♂, 24 mm.; ♀, 25 mm.; of pronotum, ♂, 5.6 mm., ♀, 5.25 mm.; width, ♂, 7 mm., ♀, 6.5 mm.; length of tegmina, ♂, 3.5 mm.; of hind femora, ♂, and ♀ 23 mm.; of hind tibiæ, ♂, 27 mm.; ♀, 23.5 mm.; of ovipositor, 16 mm.

*Habitat*.—The types, male and female, come from the "Province del Sara, Bolivia," the male 450 meters and the female 350 meters above sea-level, October, 1913 (J. Steinbach). These with several other males and a nymph are the property of the Carnegie Museum.

#### Genus ARACHNOMIMUS Saussure.

*Arachnomimus* SAUSSURE, Biol. Cent.-Amer., Orth. I (1897), p. 251; KIRBY, Syn. Cat. Orth., II (1906), p. 70.

*Arachnopsis* SAUSSURE (*non* Stimpson), Mém. Soc. Genève, XXV (1878), p. 442.

As indicated by the synopsis of the South American genera of Phalangopsitidæ, the representatives of the present genus are without auditory openings on the anterior tibiæ, hence possibly without stridulating apparatus as well. Two species have been recorded from tropical America prior to this time. Now specimens are at hand which seem to indicate a third.

#### 61. *Arachnomimus bahamaënsis* sp. nov.

Moderately large and rather robust, with annulate anterior and middle legs. Dark wood-brown, becoming almost black on the occiput, pronotum, and base of the abdomen above, varied with bands and blotches of paler, almost dirty white.

Head short, a little narrower than the anterior margin of the pronotum, the eyes prominent, pyriform, the apex or narrower portion below; the apex of head slightly advanced between the antennæ into a short rostrum, the anterior ocellus large, situated in a depression at the top of the vertical front and immediately back of a prominent transverse ridge, posterior ocelli also rather large and located fairly close together, but far to the rear of the anterior one, thus forming an acute triangle. Antennæ long and slender. Pronotum nearly twice as broad as long, the sides a little rounded, slightly wider at the base than the apex, both margins nearly straight; the lateral lobes narrowed posteriorly, both the anterior and posterior angles rounded. Body entirely apterous. Anterior and middle legs long and slender, hind legs also moderately long, the femora robust at base, slender at the apex, the hind tibiæ serrate with 4 : 4 spines on their apical half,

the metatarsus above spined on both sides, internally three or four, externally seven or eight spines, the upper internal spur shorter than the median. Cerci very long, slender, and hirsute; the ovipositor moderately robust, with its apex acute. Entire body sericeous, also to a limited extent hirsute.

Length of body, ♂, 13 mm., ♀, 16 mm.; of pronotum, ♂, 3 mm., ♀, 3.5 mm.; width, ♂, 5 mm., ♀, 6 mm.; of hind femora, ♂, 15 mm., ♀, 17 mm.; of ovipositor, 9 mm.

*Habitat*.—Male and female, Blue Hills, Nassau, Bahama Islands, January, 1909. The types and three additional males are at hand. They are deposited in the Carnegie Museum. All of these insects seem to be somewhat immature and may represent the last nymphal instar.

This insect resembles the *Amphiacusta annulipes* Serville in its general appearance.

#### Family ŒCANTHIDÆ.

This family is made up of slender-bodied, herb-dwelling crickets, which are usually recognized under the name of "tree-crickets." Only two genera have been credited thus far to the American hemisphere. One of these, *Œcanthus*, is cosmopolitan, and is represented by two dozen or more species. The other, *Neoxabea*, is only known to occur in America. These two genera may be separated as follows:

##### SYNOPSIS OF THE SOUTH AMERICAN GENERA OF ŒCANTHIDÆ.

- A. Hind tibiæ armed on their margins with weak spines and fine serrations between the spines. Basal joint of the antennæ smooth or at most armed below with a very blunt tubercle. Hind wings usually but little, if any, longer than the front pair. Anal cerci rather long and slender, not sinuate.  
*Œcanthus* Serville.
- AA. Hind tibiæ unarmed even with fine serration. Antennæ with the basal joint provided at apex with a tooth-like tubercle. Hind wings nearly twice the length of the front pair. Anal cerci short, robust, sinuose. . . *Neoxabea* Kirby.

#### Genus ŒCANTHUS Serville.

*Œcanthus* SERVILLE, Ann. Sci. Nat., XXII (1831), p. 134; Ins. Orth. (1839), p. 358; BURMEISTER, Handb. Ent. II (1838), p. 731; SAUSSURE, Miss. Mex., Orth. (1874), p. 456; Biol. Cent.-Amer., Orth. I (1897), p. 252 and numerous recent writers.

The present genus is represented by quite a number of apparently distinct species in the two Americas, some of which no doubt occur in portions of both.

These insects have been separated by the use of such characters as comparative length and width of tegmina, length of wing, form of body, form of pronotum, etc., also by the presence or absence of dusky markings on the basal and sub-basal antennal joints. This latter character has been adopted in recent years as quite characteristic, at least for our North American forms.

In food-habits these crickets are supposed to be partially insectivorous, feeding upon aphids and other small delicate insects, which they find among the foliage which affords them shelter. Their eggs are deposited in the buds, bark, and stems of various plants.

Eight species of this genus have been credited to South American countries. The specimens at hand in part can be referred to one or another of those species. Two of these specimens do not, however, appear to belong with any of them. The subjoined synoptical key will aid in their recognition:

SYNOPSIS OF THE SOUTH AMERICAN SPECIES OF *ŒCANTHUS*.

- A. First and second antennal joints obtusely tuberculate below, each marked with a black dot. [Cuba, Central America]..... *niveus* DeGeer.
- AA. First and second antennal joints not tuberculate, but first joint sometimes swollen internally.
  - b. Basal antennal joints unicolorous, without black markings. First joint swollen internally. [Trinidad]..... *immaculata* Bruner.
  - bb. First and second antennal joints marked below with black.
    - c. Tegmina and wings about equal in length.
      - d. Size minute (male to tip of tegmina 9.5-10 mm.), graceful. First antennal joint gently swollen internally, faintly lined with brown. *minutus* Saussure.
      - dd. Size larger (male to tip of tegmina 13 mm.), robust. First antennal joint a little swollen below, the first and second longitudinally lined with black. [Chapada and Rio Grande do Sul, Brazil] *lineolatus* Saussure.
    - cc. Tegmina shorter than the somewhat caudate wings.
      - d. First antennal joint marked below with a longitudinal line and an apical dot, the second with a dot. [Mexico, Argentina] *argentinus* Saussure.
      - dd. First and second antennal joints below both marked with longitudinal black lines.
        - e. Larger (female to tip of wings 23 mm.) very slender. [Brazil] *varicornis* Walker.
        - ee. Smaller (female 16-18 mm.), slender. [Santarem and interior Brazil]..... *lenuis* Walker.<sup>5</sup>

<sup>5</sup> Walker's descriptions are so poor and meager that it is next to impossible for one to definitely determine the insects referred to. Evidently the species *varicornis*, *lenuis*, and *peruvianus* are very similar, if not identical.



62. *Æcanthus niveus* (DeGeer).

*Gryllus niveus* DEGEER, Mém. Ins., III (1773), p. 522, Pl. 43, fig. 6; OLIVIER, Enc. Meth., Ins., VI (1791), p. 637.

*Acheta nivea* JÆGER, N. Amer. Ins. (1854), p. 159, Pl. 5, fig. 26.

*Æcanthus niveus* SERVILLE, Ins. Orth. (1839), p. 361; HARRIS, Insects Injurious to Vegetation (1841), p. 124, and numerous recent writers.

*Æcanthus niveus* var. *e. discoloratus* FITCH, Rep. Ins. N. York, III (1856), p. 95.

*Æcanthus niveus* var. *f. fuscipes* FITCH, l. c. (1856), p. 95.

*Habitat*.—While there are no representatives of *niveus* among the material now being reported upon, it is a well-known fact that the species occurs both in Mexico and some of the Central American countries and several of the West Indian islands.

63. *Æcanthus immaculatus* Bruner.

*Æcanthus immaculatus* BRUNER, Journ. N. Y. Ent. Soc., XIV (1906), p. 164.

*Habitat*.—The present writer has a single female specimen in his collection which was taken on the Island of Trinidad. This species probably also occurs in northern South American countries. It is related to *niveus*, but lacks the black dots on the underside of the first and second antennal joints.

There is a female specimen of the genus at hand coming from Corumbá (highlands), Brazil, taken in March, also without maculate basal antennal joints. It is shorter-winged, more robust, and has the hind tibiæ more strongly serrated than in the type of *immaculatus*. Its hind femora are also correspondingly shorter and more robust than in that species, while the ovipositor is longer and the cerci shorter. The pronotum likewise is shorter than in *immaculatus*, as are the hind wings. Its color is much as in *niveus*, the body and limbs being very pale flavous. Should this insect prove to represent a distinct species it may be called *Æcanthus brasiliensis*.

Length of body, ♀, 10.5 mm., of tegmina, 8 mm., of wings, 10.5 mm., of hind femora, 7.5 mm.

The type is deposited in the Carnegie Museum.

64. *Æcanthus minutus* Saussure.

*Æcanthus minutus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 454; KIRBY, Syn. Cat. Orth., II (1906), p. 75.

*Habitat*.—There are four specimens, three males and one female, of an *Æcanthus* at hand, which are placed here. They were taken during the month of April at Chapada, Brazil (H. H. Smith, collector).

These insects are very small, averaging 10 mm. to the tips of the wings, which are no longer than the narrow tegmina. Basal antennal joints as described in the synoptical key.

65. *Æcanthus argentinus* Saussure.

*Æcanthus argentinus* SAUSSURE, Miss. Mex., Orth. (1874), p. 460; Biol. Cent.-Amer., Orth., I (1897), p. 253; Kirby, Syn. Cat. Orth., II (1906), p. 74.

*Habitat*.—While the collections now at hand do not contain specimens which can be referred to this species, it is quite certain that the species belongs to tropical and subtropical America. It may be recognized by the form of the dusky antennal markings of the basal antennal joints, *i. e.*, the line and dot on the first and the dot on the second.

66. *Æcanthus lineolatus* Saussure.

*Æcanthus lineolatus* SAUSSURE, Biol. Cent.-Amer., Orth., I (1897), p. 254; KIRBY, Syn. Cat. Orth., II (1906), p. 75.

*Habitat*.—A single male specimen from Chapada, Brazil, is placed under this name. It was taken in May, presumably by H. H. Smith.

67. *Æcanthus tenuis* Walker.

*Æcanthus tenuis* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 95; SAUSSURE, Miss. Mex., Orth. (1874), p. 461; KIRBY, Syn. Cat. Orth., II (1906), p. 75.

Under this name I am including several specimens, which vary considerably among themselves in size, comparative length of thorax, etc. They all agree, however, in having the two basal joints of their antennæ provided below with a slender median longitudinal line of black. Possibly Walker's three so-called species *varicornis*, *tenuis*, and *peruvianus* would be included. This can only be decided by a careful study of his types together with a large series of specimens of both sexes from various South American localities.

*Habitat*.—The material just referred to is represented as follows:

Three females and one male, Chapada, taken during the months of April and May; a single female from Rio de Janeiro, October (H. H. Smith); a female bearing the label "Rio Bermejo, Prov. of Salta, Argentina, 400 M. Steinbach," May, 1914, Carnegie Mus. Acc. 5229.

68. *Æcanthus* sp.?

In addition to the above there is before me and apparently belonging to the same collection a single male without locality label, but with

one simply for the month of July. This male seems to agree fairly well with Beutenmüller's *Æcanthus pini*. Could it not be possible that this specimen of a local species became mixed with the South American material at the time of pinning and labeling?

### Genus NEOXABEA Kirby.

*Neoxabea* KIRBY, Syn. Cat. Orth., II (1906); p. 76.

*Xabea* RILEY (*non* Walker), Rep. Ins. Mo., Index & Suppl. (1881), p. 62; BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), p. 272; BLATCHLEY, Rep. Indiana Dept. Geol., XXVI (1903), pp. 444, 453.

The insects which constitute this genus are found over a considerable portion of temperate and tropical North America and in tropical South America from Colombia to eastern Brazil. Only three species are known, two of which are now described for the first time. In general appearance they resemble the larger and slenderer species of the genus *Æcanthus*, from which they differ in such characters as mentioned on a former page in the synoptical key for separating the American genera of the family *Æcanthidæ*. Nowhere do these insects seem to be abundant or even common. In habit they are supposed to be similar to the tree-crickets belonging to the genus *Æcanthus*.

A. Size smaller, graceful (male, length to tip of wings 20 mm.). Pronotum little, if any, wider at the base than at the apex; veining of the tegmina quite regular and uniform, the veins slender [Rio de Janeiro, Brazil].

*obscurifrons* sp. nov.

AA. Size larger, more robust (female, length to tip of wings 25 mm.). Pronotum decidedly wider at its base than at the apex; veining of the tegmina somewhat irregular, some of the veins enlarged.

b. Tegmina without markedly robust oblique veins on the dorsum, marked above on each elytron with a prominent median and anterior fuscous blotch. [Mexico, Central America, and the United States east of the Plains].....*bipunctata* De Geer.

bb. Tegmina furnished with robust oblique veins on the dorsum, these veins infuscated [Colombia].....*meridionalis* sp. nov.

### 69. *Neoxabea obscurifrons* sp. nov.

Having the same general form, but plainly smaller than both *N. bipunctata* and *N. meridionalis*, which latter is also described in this paper.

Head plainly broader than the anterior edge of the pronotum; eyes rather prominent and with the facets moderately large, giving to them

a granular appearance, narrowed anteriorly, a little longer than the occiput back of them; the basal antennal joint robust and provided at its apex internally with a blunt tooth. Pronotum very similar to that of the other described species, nearly twice as long as wide, the anterior margin nearly straight, the hind margin sinuate, but to a less degree than in *N. meridionalis*, the rugose border narrower than in that species. Tegmina about as long as the abdomen, the venation regular, none of the veins especially prominent, as is the case in this sex of *N. meridionalis* where several of the oblique veins are much heavier than the others, on the costal field also quite regular; wings lengthily caudate, extending beyond the tegmina a distance of about two-thirds the tegminal length. Legs very slender, the hind tibiæ entirely destitute of spines on their margins; anterior tibiæ perforated on both sides, as in both of the other species, their basal half fusiformly dilated. Cerci sinuose as described for *N. meridionalis*, and as also in *bipunctata*. Ovipositor slender, a little shorter than the hind femora.

General color uniformly pale flavo-testaceous with the exception of the front and occiput, which is dark, varying from brown between the base of the antennæ to deep pitchy black on the occiput. In the middle of this dusky area is a narrow median longitudinal flavous line, and at either side of it is a little wider gray one composed of a scale-like covering or pruinescence on the dusky background.

Length of body, ♀, 12 mm., of pronotum, 2.7 mm., of tegmina, 9.5 mm., of hind femora, 7 mm., of ovipositor, 5 mm.

*Habitat*.—Rio de Janeiro, Brazil, in October (H. H. Smith), two females. These insects are the property of the Carnegie Museum.

#### 70. *Neoxabea meridionalis* sp. nov.

About the same in size and general form as *N. bipunctata* DeGeer, but without the well-defined black dots on the tegmina, which are so prominent in that species. General color rusty testaceous, the principal veins of the tegmina, especially the oblique ones and the cross-veins near the base, knees, and tarsi of all the legs, stained brown, in some specimens inclining to black.

Head a little broader than the front edge of the pronotum, fully as long as the pronotum, when the mouth is directed forward, the eyes as long as the occiput back of them. Basal antennal joint large and

provided at apex below with a short blunt spine. Pronotum about twice as long as its extreme width; the lateral edges sinuose, somewhat expanding above the insertion of the anterior pair of legs in a similar manner to this portion of many mantids; the hind portion rather suddenly amplified and provided above just in advance of the apex with a fold that is parallel to the hind margin, and which is also reinforced. Tegmina long and narrow, reaching the tip of the abdomen in both sexes, irregularly but strongly veined on the dorsum, those on the sides more regular. Wings caudate, fully one-half longer than the tegmina. Legs rather long and slender, hind femora just surpassing (♀) or greatly prolonged beyond the tips of the elytra (♂), hind tibiae a little longer than the femora, with only a few weak spines on their distal half. Dorsum of the abdominal segments four, five, and six provided with rather large tubercles, or swellings, which may be either single or double. Anal stilets, or cerci, quite heavy and somewhat twisted or sinuate, of the same form in both sexes. Ovipositor straight, the apex not enlarged, infuscated.

Length of body, ♂ and ♀, 14-16 mm.; of pronotum, 2.9 mm.; of tegmina, ♂, 10-11 mm., ♀, 12 mm.; of hind femora, 8.5 mm.; of ovipositor, ♀, 6.25 mm.; of cerci, 2 mm.

*Habitat*.—Valparaiso (4,500 ft.), Department of Magdalena, Colombia, S. America, five males and one female, April (H. H. Smith). Types deposited in the Carnegie Museum.

#### Family TRIGONIDIIDÆ.

This family is made up of small, active insects, which are well scattered over the warmer regions of the earth. Several of the genera are represented in South America. These may be recognized by referring to the accompanying synoptic key:

#### SYNOPSIS OF THE GENERA OF TRIGONIDIIDÆ WITH SPECIAL REFERENCE TO TROPICAL AMERICA.

- A. Last joint of the maxillary palpi, usually, but not always, broadly hatchet-shaped. Antennæ with the basal joint subdepressed, rather large. Lateral lobes of the pronotum subquadrate, their inferior margin nearly horizontal, very gently hollowed at middle. Antennal foveolæ large. Front between the antennæ narrowly rostrate.
- b. Terminal joint of the palpi triangular. Tegmina in both sexes corneous, without a tympanum in the males.
- c. Anterior tibiae without a perforation, or opening; wings aborted. [Oriental].....*Trigonidium* Rambur.



- cc. Anterior tibiæ provided with auditory perforations, or openings, on both sides. . . . . *Metioche* Stål.
- bb. Terminal joint of the palpi either dilated at the apex or simple. Tegmina of the female coriaceous, of the male membranous, and furnished with a tympanum.
- c. Anterior tibiæ furnished with a single auditory opening, or none. Wings abbreviated.
- d. Front tibiæ without an auditory opening. [Southeastern United States]. . . . . *Falcicula* Rehn.
- dd. Front tibiæ usually with a single, none, or sometimes with two auditory openings.
- e. Terminal joint of the palpi dilated. Auditory openings circular or elliptical, one, two. Tegmina membranous, the veins well-developed. Color of insect modest. [North and South America]
- f. Anterior tibiæ with two auditory openings. Wings variable, but usually caudate. . . . . *Cyrtoxipha* Brunner.
- ff. Anterior tibiæ with a single or rarely no auditory opening, usually abbreviated . . . . . *Anaxipha* Saussure.
- ee. Terminal joint of the palpi tubiform. Auditory apparatus linear, imperforate. Tegmina corneous, the veins poorly defined. Color of insect bright. [Costa Rica]. . *Symphylloxiphus* Rehn.
- AA. Last joint of the palpi dilated, foliaceous. Antennæ with the basal joint small, narrow. Lateral lobes of the pronotum narrowed anteriorly, the lower margin entire. Tegmina corneous, furnished with a tympanum in the male. Anterior tibiæ perforated from both sides.
- b. Head vertical, trigonal. Front between the antennæ narrowly rostrate. Antennal foveolæ rather large. Pronotum short, subselliiform, the anterior angles expanded and subreflexed. [Tropical America]
  - Thamnoscirtus* Saussure.
- bb. Head porrect, subhorizontal, flattened above. Front between the antennæ broad. Antennal foveolæ small. Pronotum variable, trapezoidal, or elongate-cylindrical, the lateral margins straight. [North and South America]. . . . . *Phylloscirtus* Guérin.

#### Genus METIOCHE Stål.

- Metioche* STÅL, Cefv. Vet.-Akad. Forh., XXXIV, pt. 1 (1877), p. 44; KIRBY, Syn. Cat. Orth., II (1906), p. 78.
- Piestoxiphus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 467; Abhandl. Senkenb. Ges. XXI (1899), p. 606; KARSCH, Berl. Ent. Zeitschr., XXXVIII (1893), p. 161.

This seems to be an oriental genus, which for the most part is confined to the Indo-Chinese region, as well as to Oceanica to the eastward. A very few forms of the genus, however, are to be found in the African region. Recently a single species has been described from northern South America.

71. *Metioche americana* Chopard?

*Metioche americana* CHOPARD, Ann. Soc. Ent. France, LXXXI (1912), p. 406, 3 figs.

*Habitat*.—Originally described from La Forestiere, French Guiana, where it was collected in April. The present author is in possession of a male from Demarara, British Guiana, where it was collected early in 1901 by a Mr. R. J. Crew. The Carnegie Museum material also contains a female specimen from Chapada, Brazil, which seems to belong here. It was taken in April by H. H. Smith.

## Genus CYRTOXIPHA Brunner.

*Cyrtoxipha* BRUNNER, Mitth. Schweiz. Ent. Ges., IV (1873), p. 168; SAUSSURE, Miss. Mex., Orth. (1874), p. 373; KIRBY, Syn. Cat. Orth., II (1906), p. 80.

*Cyrtoxiphus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 476; BRUNNER, Ann. Mus. Geneva, XXXIII (1893), p. 21.

The insects which compose the present genus are well scattered over the warmer parts of the earth, very sparsely so in the temperate regions, but rather plentifully in the tropics, especially of South America and Oceanica. A few also have been recorded from African regions and the islands of the Indian ocean.

The genus is separable into several sections based on variations in structural features, such as form and texture of tegmina, length of wings, shape of the anterior tibiae and their auditory foramina, color, size, etc. Up to the present time about thirty so-called species have been named. The descriptions of these have been so varied, however, that it is next to impossible for one to draw up a workable synoptical key for their separation.

The material now at hand represents quite a number of forms in addition to those here listed. Some of these latter are represented by single specimens, others by imperfect ones, and still others by several individuals showing variation in both size and color. In order to properly classify our American species of the genus much close collecting is necessary in all of the regions inhabited by its members. Rather full notes on their haunts, habits, and life-history are also much needed for use in such a study. Four new forms are described in the present paper. Others no doubt are at hand, but for one or more reasons are put aside for future study.

72. *Cyrtoxipha gundlachi* Saussure.

*Cyrtoxipha gundlachi* SAUSSURE, Miss. Mex., Orth. (1874), p. 373, Pl. 7, fig. 2;

KIRBY, Syn. Cat. Orth., II (1906), p. 82.

*Cyrtoxiphus gundlachi* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 480; BOLÍVAR, Mem. Soc. Zoöl. France, I (1888), p. 158.

*Habitat*.—Originally described from the West Indies, and especially the Island of Cuba, and since recognized among material from the southern part of the United States and from northern South American countries. A specimen from Pará, Brazil (H. H. Smith), is referred to this species.

### 73. *Cyrtoxipha cayennensis* Saussure?

*Cyrtoxiphus aztecus* var. *cayennensis* SAUSSURE, Biol. Cent.-Amer., Orth., I (1897), p. 235.

*Habitat*.—While the original specimens were taken in Guiana, there are two female specimens of a rather small, dusky *Cyrtoxipha* before me, which I am inclined to refer to this species. They were taken at Santarem, Brazil, by H. H. Smith. Owing to the considerably smaller size, these specimens may be distinct. The female of *C. azteca* measures 9.3 mm. to tip of their wings, while ours are only 8 mm. long, including the wings.

### 74. *Cyrtoxipha variagata* Chopard.

*Cyrtoxipha variegata* CHOPARD, Ann. Soc. Ent. France, LXXXI (1912), p. 497, 3 figs.

*Habitat*.—Although the collections which were submitted to me for study contained no specimens of this insect, some are contained in the writer's collection. They were collected some years ago in British Guiana. Both sexes are represented.

### 75. *Cyrtoxipha nitida* Chopard.

*Cyrtoxipha nitida* CHOPARD, Ann. Soc. Ent. France, LXXXI (1912), p. 408, 2 figs.

*Habitat*.—Like the preceding this slender little insect is not represented in the Carnegie collections, except by a single imperfect male specimen, which comes from Chapada, Brazil, where it was taken during the month of October (H. H. Smith). A pair in the writer's collection were collected in British Guiana by H. D. Chipman.

Both *C. nitida* and *C. variegata* have been labeled as new species in my collection for several years. Now it is a relief to know that Chopard has named and figured them so carefully that no further difficulty should arise as to their identity.

76. *Cyrtoxipha angusticollis* Saussure.

*Cyrtoxipha angusticollis* SAUSSURE, Miss. Mex., Orth., (1874), p. 377, Pl. 7, fig. 2;

KIRBY, Syn. Cat. Orth., II (1906), p. 82.

*Cyrtoxiphus angusticollis* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 488, Pl. 19, (LXXX) fig. 6; Biol. Cent.-Amer., Orth., I (1897), p. 238.

*Habitat*.—The collection contains three male representatives of this species. Two of them bear the label Cacagualito (1500 ft.), Colombia. They were taken by H. H. Smith. The third comes from São Luiz de Cáceres, Matto Grosso, Brazil, where J. D. Haseman took it on May 29, 1909. Other specimens are before me, which were taken in British Guiana. These latter are in the writer's collection. It was originally described from Mexico and Panama.

77. *Cyrtoxipha peruviana* Saussure?

*Cyrtoxipha peruviana* SAUSSURE, Miss. Mex., Orth. (1878), p. 378; KIRBY, Syn. Cat. Orth., II (1906), p. 83.

*Cyrtoxiphus peruvianus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 488.

*Habitat*.—A considerable number of specimens of the genus have been determined provisionally as Saussure's *C. peruviana*, but all of them come from localities rather distant from where the type was taken. Specimens so determined come from Cacagualito (1,500 ft.) two males, two females; Don Amo, 200 ft. one female, and Don Diego, 100 ft., one female, Dept. Magdalena, Colombia (H. H. Smith). There are also specimens from Pará, and Chapada, Brazil (H. H. Smith).

78. *Cyrtoxipha tibialis* (Saussure)?

*Cyrtoxiphus tibialis* SAUSSURE, Biol. Cent.-Amer., Orth., I (1897), p. 236, Pl. 11, fig. 40.

*Cyrtoxipha tibialis* KIRBY, Syn. Cat. Orth., II (1906), p. 82.

*Habitat*.—Some of the specimens coming from Cacagualito, Colombia, have been doubtfully referred to this species.

Another species of the genus *Cyrtoxipha* is represented in the author's collection by four specimens, which were taken at Carcaraña and Rosario, Argentina, during the summer of 1898. Since it seems to be undescribed a brief characterization is presented herewith.

79. *Cyrtoxipha atrifrons* sp. nov.

As the name indicates, this insect may be readily recognized by its pitch-black face. Otherwise it resembles *C. angusticollis* and allies in general color and size.

Of moderate size. Body slender. General color of legs, tegmina, and wings pallid-testaceous tinged with cinereous. Head a little wider than the anterior edge of the pronotum, the eyes prominent, the vertex a little depressed, and gently sulcate anteriorly, in the male mostly black, in the female varied with testaceous and ferruginous, the front below the antennæ and the eyes of both sexes glossy black, save in the female, where the base of the clypeus is transversely flavous. Pronotum short, broad, evenly expanding to the base, the anterior margin and lateral lobes largely piceous, the disc irregularly variegated with fuscous; near the hind margin and parallel with it is a series of rounded black or dark brown dots, from the centers of which emanate stiff dusky bristles, the median area provided with a longitudinal pallid line. Tegmina of both sexes a little longer than the abdomen, those of the female with five longitudinal veins on the dorsal and three on the lateral field, on the latter a couple of patches of fuscous. Abdomen varying from dirty testaceous to dull black. Hind femora robust, their outer face sometimes having a narrow longitudinal fuscous line along the middle. Ovipositor robust, short, the apex acuminate, the edges and carinæ finely crenulate, the transverse notch located at about the middle. Anterior tibial openings rather large, elliptical.

Length of body with wings, ♂ and ♀, 13 mm.; of tegmina, ♂, 6.5 mm.; ♀, 6 mm.; of hind femora, 6 mm.; of ovipositor, 2 mm.

*Habitat*.—Middle Argentina. The type is in the collection of the author.

#### 80. *Cyrtoxipha conspersa* sp. nov.

Above the average in size, a pale cinereous insect in which the legs, head, pronotum, and tegmina are conspersed with fuscous spots and dots.

General color dirty grayish flavous, the antennæ distantly fasciate with fuscous. Head of moderate size, a little broader than the anterior portion of the pronotum, the eyes large and prominent, separated by a space about equal to their longest diameter, the vertex depressed in the form of a broad arcuate transverse valley, followed anteriorly by a ridge, which separates this region from the front; antennal pits large and profound, occupying fully three-fourths of the space between the lower half of the eyes; rostrum prominent, studded with several coarse downwardly bent bristles, the ocelli small. An-



tennæ moderately long, the basal segment large. Pronotum divergent posteriorly, somewhat wider than long, the disc irregularly embrowned, provided with a median depressed longitudinal line, the front shallowly emarginate, the lateral lobes of moderate depth, the anterior angle obliquely, the posterior angle evenly, rounded, hind margin sinuose; the lateral lobes each prominently marked by two moderately large fuscous spots, the posterior portion of the dorsum furnished a little in advance of the margin by a row of equidistant round fuscous dots from the center of which emanate stiff bristles. Tegmina a little longer than the abdomen, provided with strong longitudinal veins and regular cross-veins, the interspaces strongly depressed, giving to these members a strongly corrugated appearance, lateral field with two complete and one incomplete vein, the upper interspace alone provided with cross-veins. Wings slightly infuscated, their cross-veins pallid, lengthily caudate. Legs long and slender, the anterior tibiæ fusiform, both sides provided with moderately large elliptical auditory openings, the apex of all the femora, the tibiæ, and tarsi marked with some fuscous patches; hind femora slender, the carinæ conspersed with fuscous, tip of the tibiæ, the second segment entirely, and the apex of the outer, fuscous. Ovipositor fairly robust, well-curved and with its apex coarsely serrated both above and below, the former for nearly twice the distance of the latter.

Length to tip of wings, ♀, 13.75 mm., of body, 8 mm., of pronotum, 1.5 mm., width, 2.3 mm., length of tegmina, 7 mm., of hind femora, 7 mm., of ovipositor, 3.75 mm.

*Habitat*.—The type, a female, comes from "Las Juntas (250 M.), Dept. Sta. Cruz, Bolivia," where it was taken during the month of December by J. Steinbach. A second female specimen is also at hand. It was collected at Villa Bella, Bolivia, Oct. 7, 1909, by Haseman. Both specimens are in the Carnegie Museum.

#### 81. *Cyrtoxipha maxima* sp. nov.

Large and moderately robust, with a strongly hirsute pronotum and sericeous legs. General color pale ferrugineo-flavous.

Head a little wider than the front edge of the pronotum; eyes fairly prominent; the vertex of moderate width, somewhat depressed, provided with a few bristle-like hairs; the rostrum blunt, about as broad as the greatest diameter of one of the basal antennal joints,

apical segment of the maxillary palpi lengthily funnel-shaped, its apex squarely docked. Pronotum transverse, widest behind, the humeri rounded, the anterior and posterior margins straight ( $\sigma^7$ ), or the latter faintly sinuose with the middle very broadly rounded ( $\varphi$ ). Tegmina membranous, in both sexes about equal to the abdomen in length, the dorsal field of these organs of the female provided with four longitudinal veins, cross-veins comparatively few, but regular, the lateral field with three complete and one incomplete vein. Male tegmina large and furnished with a large speculum. Wings lengthily caudate, the apical half testaceous. Hind femora large, robust, the genicular lunules piceous; hind tibiae infuscated at the points of issuance of the movable spines; second segment together with the spines and the apex of the third joint of the hind tarsi infuscated. Anterior tibiae slender, the auditory openings on both sides large and elliptical. Ovipositor robust, short, gently curved, the apex not very acuminate, smooth.

Length of body,  $\sigma^7$  and  $\varphi$ , 8.5 mm.; of pronotum,  $\sigma^7$ , 1.55 mm.,  $\varphi$ , 1.65 mm.; width,  $\sigma^7$ , 2.5 mm.,  $\varphi$ , 2.25 mm.; length of tegmina,  $\sigma^7$  and  $\varphi$ , 7 mm.; of hind femora,  $\sigma^7$ , 7.5 mm.,  $\varphi$ , 7 mm.; of ovipositor, 2.15 mm.

*Habitat*.—The male type comes from the "Province del Sara, Bolivia, 350 M." and the female from "Sta. Cruz de la Sierra, Bolivia, 450 M." Both were collected by J. Steinbach. Other specimens (male and female) are at hand. These latter were also taken in the Province del Sara, Bolivia, during the month of December, 1912. They are deposited in the Carnegie Museum.

## 82. *Cyrtoxipha abbreviata* sp. nov.

At first glance reminding one of *Anaxipha pallida* Stål, but a closer examination shows it to possess many of the characteristics of *Cyrtoxipha* and suggests the *C. aptera* Chopard. Our specimens differ from this last mentioned insect, however, in several respects. Instead of being simply "testaceous" it is ferruginous with piceous and fuscous markings. The female of the present species, as indicated by the type, has the dorsal field of the tegmina provided with seven longitudinal veins and the lateral field with but three.

Size, medium, form robust; the head large, a little broader than the front margin of the pronotum; eyes prominent, vertex depressed, but

rounded; rostrum short, broad; basal antennal segment black, large, and with a large, round, smooth, amber-colored, eye-like protuberance on the basal half of the upper side; the two succeeding segments also black, beyond pallid, changing apically to fuscous; face and mouth-parts black, shining; terminal segment of palpi elongate-triangular. Pronotum clothed with coarse hairs, in the female subcylindrical, but little, in the male decidedly, expanding towards the base, the base in former broadly rounded, in the latter straight. Tegmina of female somewhat coriaceous, a little shorter, in the male a little longer, than the abdomen, with the speculum large and slightly elongate. Hind femora moderately robust. Anterior tibiae perforated on both sides, the openings large and oblong. Ovipositor robust, arcuate, the apex evenly tapering and gently roughened above.

Length of body, ♂, 5.6 mm.; ♀, 6 mm.; of pronotum, ♂, 1.35 mm., ♀, 1.25 mm.; width, ♂, 1.9 mm., ♀, 1.3 mm.; length of tegmina, ♂, 5.25 mm., ♀, 3.5 mm.; of hind femora, ♂ and ♀, 5.15 mm.; of ovipositor, 2.9 mm.

*Habitat*.—Chapada, Brazil, Jan., April, May, and Nov. (H. H. Smith). Several males and females. The types are deposited in the Carnegie Museum.

The abdomen and sides of the pronotum and the lateral field of the tegmina vary from dark brunneo-ferruginous to black. The legs are to some extent infuscated in the form of bands, and the veins of the male tegmina are likewise varied with piceous.

### Genus ANAXIPHA Saussure.

*Anaxipha* SAUSSURE, Miss. Mex., Orth. (1874), p. 370; BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), pp. 267, 273; BLATCHLEY, Rep. Indiana Dept. Geol. XXVII (1903), p. 454; KIRBY, Syn. Cat. Orth., II (1906), p. 86. *Anaxiphus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 475.

The representatives of this American genus are rather closely related to those of *Cyrtoxipha* and may be recognized by the characters mentioned in the synopsis of the genera given on a preceding page of this paper. Only a very few species have thus far been recognized. Possibly others may occur in middle and South American countries.

### 83. *Anaxipha pallens* (Stål)?

*Trigonidium pallens* STÅL, Eugenie's Resa, Orth. (1860), p. 318.

*Anaxipha pallens* SAUSSURE, Miss. Mex., Orth. (1874), p. 372; KIRBY, Syn. Cat. Orth., II (1906), 87.

*Habitat*.—Specimens of an insect coming from the following localities have been referred somewhat doubtfully to this species: Corumbá, Brazil, April, one female, Piedra Blanca, April, two males and one female, all presumably having been taken by H. H. Smith. All four of the specimens are rather strongly infuscated in their general coloring and may belong to a distinct species.

A fifth specimen, a female, is also present. This last one bears the label "Bahia (West Side), Brazil, Oct. 26, 1907, by sweeping in reeds and grass in a swampy place near the sea, J. D. Haseman." Possibly the true *A. pallens*, since it agrees better with Stål's characterization of the species.

#### Genus SYMPHYLOXIPHUS Rehn.

*Symphylloxiphus* REHN, Proc. U. S. Nat. Mus., XXX (1906), p. 603.

*Symphylloxiphus* is another of the tropical American genera of the Trigonidiidæ which is very apt to be found in the region covered by this paper. It is related to the preceding genus, from which its members differ as indicated by the generic synopsis given on a preceding page. Only a single species, *S. magnificum* Rehn, has been described thus far. It comes from Costa Rica.

#### Genus THAMNOSCIRTUS Saussure.

*Thamnoscirtus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 490; KIRBY, Syn. Cat. Orth., II (1906), p. 84.

The little crickets referred to the present genus look more like coleopterous insects than like gryllids. They move about rather rapidly over the vegetation, as do the insects they resemble. In color they are black, blue, green, or yellow, and more or less streaked or dotted as are tiger-beetles. They are confined to tropical America and chiefly, but not entirely, to the countries in the northern parts of South America. Five species have been described.

#### 84. *Thamnoscirtus cicindeloides* (Gerstæcker).

*Phylloscirtus cicindeloides* GERSTÆCKER, Stett. Ent. Zeit., XXIV (1863), p. 428; SAUSSURE, Miss. Mex., Orth., (1874), p. 369.

*Phylloscirtus vittatus* BURMEISTER, Abhandl. Ges. Halle, XV (1880), p. 18.

*Thamnoscirtus cicindeloides* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 491, Pl. 16 (XLVI) figs. 1, 1e, a, b; KIRBY, l. c.

*Habitat*.—There are specimens of both sexes at hand. They come from Chapada, Pará, and Santarem, Brazil, and were collected during the months of December, January, April, and June (H. H. Smith).

85. *Thamnoscirtus vittatus* (Gerstæcker).

*Phylloscirtus vittatus* GERSTAECKER, l. c. (1863), p. 428; SAUSSURE, Miss. Mex., Orth., (1874), p. 369.

*Phylloscirtus vittatus* BURMEISTER, l. c., (1880), p. 16.

*Thamnoscirtus vittatus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 492; KIRBY, l. c. (1906), p. 84.

*Habitat*.—While there are no representatives of *T. vittatus* among the collections now being reported upon, there are two specimens in the writer's possession which were taken by R. J. Crew at Demarara, British Guiana, in 1901.

## Genus PHYLLOSCYRTUS Guérin.

*Phylloscirtus* GUÉRIN, Icon. Reg. Anim., Ins. (1844), p. 333; GERSTAECKER, Stettin. Ent. Zeit. XXIV (1863), p. 424; SAUSSURE, Miss. Mex., Orth. (1874), p. 363; KIRBY, Syn. Cat. Orth., II (1906), p. 84.

*Phylloscirtus* SAUSSURE, Mém. Soc. Genève, XXV (1897), p. 238; BURMEISTER, Abhandl. Ges. Halle, XV (1880), p. 12; BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), pp. 268, 273; BLATCHLEY, Proc. Indiana Acad. Sci., 1891, pp. 128, 137; Rep. Ind. Dept. Geol., XXVII (1903), p. 456.

*Cranistus* STÅL, Eugenie's Resa, Orth. (1860), p. 315.

*Phyllopalpus* UHLER, Proc. Ent. Soc. Philad., II (1864), p. 543.

This is another strictly American genus of small crickets, nearly all the known species of which are found in the tropical countries of South America. Up to the present time fourteen species have been described. While the collection now being studied contains but three specimens belonging to apparently that many species, one of these seems to be new and is characterized herewith.

86. *Phylloscirtus comptus* (Walker)?

*Phyllopalpus comptus* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 69.

*Phylloscirtus comptus* KIRBY, Syn. Cat. Orth., II (1906), p. 85.

*Habitat*.—A single female coming from "Puerto Suarez, Bolivia, 150 M." (J. Steinbach, collector) is referred doubtfully to Walker's *comptus*.

87. *Phylloscirtus similis* sp. nov.

Related to *P. collurides* Saussure, but much smaller. A dark-colored insect with rufous head, infuscated legs, and pallid underparts. Wings lengthily caudate.

Head rather narrow, but little wider than the anterior portion of the pronotum; eyes of medium size, not prominent, separated by a



space a little greater than their longest diameter; antennæ with rather large basal segments, these flattened and transverse, a trifle broader than long, the succeeding segments considerably smaller but moderately robust and hirsute. Maxillary and labial palpi missing, as are the greater portion of the antennæ. Pronotum short, broader than long, the base plainly wider than the apex, provided with a few anteriorly and posteriorly directed heavy bristles, the middle furnished with a longitudinal impressed line. Tegmina about as long as the abdomen, provided with heavy longitudinal veins, but without cross-veins. Wings pallid and lengthily caudate, extending fully one-half of their length beyond the tip of the abdomen, their costal field and apex infuscated. Cerci robust at base, long and lengthily hirsute, reaching a trifle beyond the apex of the caudate wings. Ovipositor gently arcuate, rather long, and with the apex lengthily acuminate. Hind femora moderately robust at the base and evenly tapering to the small apical region. Hind tibiæ provided with the usual movable spines on the lateral canthi. Pronotum entirely faintly blue black, the tegmina also black with a faint bluish tinge, upper portion and outer face, together with the lower carinæ of the hind femora black, remainder, except the apex which is pale rufous, flavous, hind tibiæ infuscated; anterior and middle femora on their apical half and the tibiæ basally heavily clouded with dull black, otherwise dirty flavous. Ovipositor piceous.

Length of body, ♀, 9 mm., of pronotum, 1.55 mm., width, 2.15 mm., length of tegmina, 6 mm., of wings, 12 mm., of hind femora, 6 mm., of ovipositor, 5 mm.

*Habitat*.—A single female, the type, comes from Puerto Suarez, Bolivia, where it was taken at an altitude of 150 meters above sea-level. (J. Steinbach, collector.) The type is in the Carnegie Museum.

#### 88. *Phylloscyrtus* sp.?

In addition to the two forms of the genus already mentioned there is a nymph of what appears to be a third species in the collection from San Antonio de Guaporé, Brazil. It was taken by J. D. Haseman on an island in the Rio Guaporé, July 26, 1909.

Judging from its color it may represent an undescribed species, but is too immature to warrant even an attempt at naming and describing it. The accession number of this last insect is 4043.

## Family ENEOPTERIDÆ.

This family is represented in South and Middle America by two, or possibly three, genera, which may be separated as follows:

- A. Anterior ocellus exerted on the anterior side of the rostrum. Legs elongate.  
Hind metatarsus very long, biseriately serrate. Tegmina fully developed  
in both sexes. [Tropical America].....*Eneopteris* Burmeister.
- A A. Anterior ocellus exerted on the superior side of the rostrum. Legs shorter,  
Hind metatarsus shorter, one-spined on one margin, four-spined on the  
other. Tegmina abbreviated in the female. [Brazil]  
*Ligypterus* Saussure, or *Lebinthus* Stål.

## Genus ENEOPTERA Burmeister.

- Eneoptera* BURMEISTER, Handb. Ent., II (1838), p. 736; SAUSSURE, Miss. Mex.,  
Orth. (1874), p. 481; KIRBY, Syn. Cat. Orth., II (1906), p. 90.  
*Eneopteris* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 531; Biol. Cent.-Amer.,  
Orth., I (1897), p. 256.  
*Platydictylus* BRULLÉ (*non* Cuvier), Hist. Nat. Ins., IX (1835), p. 176; SERVILLE,  
Ins. Orth. (1839), p. 363.

89. *Eneoptera surinamensis* DeGeer.

- Gryllus surinamensis* DEGEER, Mem. Ins., III (1773), p. 519, Pl. 43, fig. i.  
*Eneoptera surinamensis* SAUSSURE, Miss. Mex., Orth. (1897), p. 483; KIRBY, Syn.  
Cat. Orth. II (1906), p. 90.  
For extended synonymy see Kirby, *l. c.*

*Habitat*.—There are numerous specimens of this common species in the collections now being reported upon. They come from such widely scattered localities as Sta. Lagoas, Minas Geraes, Brazil; Bogotá, Colombia; Santa Cruz de la Sierra, Bolivia, etc. Other material has been studied from the Island of Trinidad, British and French Guiana, Paraguay, northern Argentina, Pernambuco, Victoria, and Rio de Janeiro, Brazil, etc. In fact the species occurs throughout tropical, Central and South America, where it is very abundant in forests among the fallen leaves and other rubbish in which it lives. It is needless to state that its color is such as to protect it quite well from various enemies, which prowl about its haunts.

Like most insects, which have a very extended distribution, this cricket varies considerably in size and also to some extent in color. In fact, the large synonymy shown in the references given in Kirby's Synonymic Catalogue of the Orthoptera would indicate such variation.

## Genus LEBINTHUS Stål.

*Lebinthus* STÅL, Æfv. Vet.-Akad. Forh., XXXIV, pt. 1 (1877), p. 50; BOLÍVAR,

An. Soc. Españ., XVIII (1889), p. 425; KIRBY, Syn. Cat. Orth. II (1906), p. 88.

*Paraenopterus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 533.

This is an oriental genus, the representatives of which, at least for the most part, are confined to the Philippines and adjacent regions. Under the generic name *Paraenopterus* of Saussure, however, Giglio-Tos has credited a species to Darien. Stål and Saussure both selected the same species for the type of their respective genera.

90. *Lebinthus elegans* (Giglio-Tos)?

*Paraenopterus elegans* GIGLIO-TOS, Boll. Mus. Torino, XII (1897), No. 301, p. 8.

*Lebinthus* (?) *elegans* KIRBY, Syn. Cat. Orth. II (1906), p. 88.

*Habitat*.—There is a single nymph at hand of what seems to be an example of this genus. As compared with typical specimens of *L. bitæniatus* from the Philippines, the nymph referred to here seems to be congeneric. The broad dorsal pale stripe as described for *elegans* will apply to our nymph. It is therefore referred to Giglio-Tos's species, but with some doubt. Our specimen seems to come from Pará (Brazil) where it was taken during the month of July presumably by H. H. Smith. It is deposited in the Carnegie Museum.

Other specimens of apparently the same insect are in the writer's collection. They were collected at Pernambuco, Brazil. Possibly they may be the immature stages of *Ligypterus heydeni* Saussure, which also occurs in Brazil.

## Family STENOGRYLLIDÆ.

This family of Grylloidea is composed of rather large and moderately robust insects, in which the hind tibiæ are biseriately spined, instead of having these members both spined and serrate. In habits these crickets are subarboreal, living on, or near, the ground among fallen leaves and herbage. Their colors are chiefly testaceous, ochraceous, or fulvous with some darker markings. At least two genera are known from tropical America.

## SYNOPSIS OF THE GENERA OF SOUTH AMERICAN STENOGRYLLIDÆ.

- A. Anterior tibiæ with an auditory opening on their inner face. Pronotum with the lateral lobes a little narrowed in front. . . . . *Stenogryllus* Saussure.
- AA. Anterior tibiæ without an auditory opening. Lateral lobes of the pronotum rounded, not narrowed in front. . . . . *Pseudogryllus* Chopard.

## Genus STENOGRYLLUS Saussure.

*Stenogryllus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 554.

Only a single species of this genus is known. It is the *Stenogryllus phthisicus* Saussure from St. Domingo, West Indies. No specimens of it are at hand.

## Genus PSEUDOGRYLLUS Chopard.

*Pseudogryllus* CHOPARD, Ann. Soc. Ent. France, LXXXI (1912), p. 411.

Like the preceding, the present genus is monotypic, containing so far as at present known only the species *P. elongatus* Chopard from French Guiana, unless we can include the insect described as *Metrypus heros* Brunner and its allies, which are mentioned below under the generic name *Tafalisca* Walker.

## Genus TAFALISCA Walker.

*Tafalisca* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 52; KIRBY, Syn. Cat. Orth., II (1906), p. 107.

*Metrypa* BRUNNER, Mith. Schweiz. Ent. Ges. IV (1873), p. 168; SAUSSURE, Miss. Mex., Orth. (1874), p. 513.

*Metrypus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 671.

The present genus is composed of about a dozen species of moderately large and fairly robust crickets, most of which are to be found in the West Indies and the northern countries of South America.

91. *Tafalisca lineatipes* sp. nov.

Most closely related to the *Metrypus luridus* of Saussure, as described in Mém. Soc. Genève, XXV, p. 673, pl. 19 (LXXIII), figs. 3h, 3b, but apparently not the same as *Tafalisca lurida* Walker.

Large, robust, testaceous, the head, legs, and abdomen covered with a close, short, pale, silky pile. The pronotum bordered narrowly in front and broadly behind by dark piceous. Hind femora provided externally with a prominent longitudinal black line, the hind tibiæ brunneo-ferruginous, and the ovipositor piceous.

Length of body, ♀, 36 mm., of pronotum, 5.5 mm., width, 6 mm., length of tegmina, 27 mm., of wings, 30 mm., of hind femora, 17 mm., of ovipositor, 16 mm.

The dorsal field of the tegmina of this insect is provided with longitudinal veins, and between them is weakly but rather closely and irregularly reticulate; at the sides the reticulation is mixed, this area

being provided with both quadrate and irregular areoles. The anterior femora are rather broadly inflated and evenly arcuate above. The hind tibiæ and metatarsi are spined, as described for *T. lurida* Saussure.

*Habitat*.—The type and only specimen at hand comes from Jamaica, W. I., and bears the Carnegie Museum Accession No. 2306.

Judging from the structure of the apex of the ovipositor of this insect and its allies I would suggest a relationship to the genus *Pseudogryllus* Chopard (Ann. Soc. Ent. France, LXXXI, p. 411) which genus, along with *Stenogryllus* are suggested as forming a separate group.

### Family PODOSCIRTIDÆ.

This is one of the most extensive families of the Grylloidea and is well represented throughout the warmer parts of the temperate countries, as well as the tropical regions of the globe.

#### SYNOPSIS OF THE SOUTH AMERICAN GENERA OF PODOSCIRTIDÆ.

- A. Body very slender. Posterior metatarsus somewhat elongate, biserially serrate. Front tibiæ minus an auditory opening. Male tegmina very small, without a tympanum (female without tegmina). [Brazil]

*Cylindrogryllus* Saussure.

- AA. Body variable. Posterior metatarsus shorter.

- b. Male tegmina provided with a complete tympanum and also furnished with a speculum, the median vein branched.

- c. Head globose, the front not rostrate, transversely carinate. Tegmina of the female broad, leathery. Anterior tibiæ perforated on both sides.

*Phyllogryllus* Saussure.

- cc. Head short, not globose, the occiput short, mouth below. Front rostrate between the antennæ.

- d. Tegmina of the male provided with many fully developed oblique veins. Front tibiæ furnished externally with auditory openings. Valves of the ovipositor variable.

- e. Posterior metatarsus compressed, carinated above, 3-4-dentate. Anterior tibiæ compressed, auditory openings present on both sides. Tympani of the tegmina with the oblique veins parallel and nearly straight. Ovipositor dentate at its apex.

*Diatrypa* Saussure.

- cc. Posterior metatarsus short, but little compressed, not carinated. Oblique veins of tegmina flexuous, not parallel.

- f. Body slender, cylindrical. Rostrum of the front narrow.

- g. Posterior metatarsus frequently two- to three-toothed. Tegmina of male provided with numerous oblique veins. Anterior tibiæ perforated on the innerside.

*Paræcanthus* Saussure.



- gg. Posterior metatarsus smooth, not toothed. Tegmina of male provided with two divergent oblique veins. Front tibiæ with oblong auditory openings on both sides. Antennæ excessively long. . . . . *Stenæcanthus* Chopard.
- ff. Body somewhat robust or depressed; head large, the rostrum of the front wide (Posterior metatarsus one- to three-toothed. Tegmina with two oblique veins.) . . . *Amblyrhethus* Kirby.
- dd. Tegmina of male with one or two incomplete oblique veins. Valves of the ovipositor lanceolate, acute.
- e. Surface of the head, pronotum, and legs somewhat wrinkled and strongly pubescent. Ocelli arranged in a triangle. Auditory opening of the front tibiæ located on the inside.  
*Laurepa* Walker.
- ee. Surface of the head, pronotum, and legs smooth and glabrous. Ocelli arranged in a transverse arcuated line.
- f. Auditory opening on the inner side. Tegmina of the female somewhat leathery, on the dorsal field the veins are distant and pectinated; the oblique branches of the mediastine vein gently flexuous. Head and pronotum a little convex.  
*Hapithus* Uhler.
- ff. Auditory openings of anterior tibiæ located on both sides. Tegmina of the female membranous, veins longitudinal; the mediastine vein with its oblique branches numerous and s-sinuous. Head and pronotum somewhat flattened from above. . . . . *Orocharis* Uhler.
- bb. Male tegmina without a tympanum, in this respect similar to the female.
- c. Anterior tibiæ furnished with auditory apparatus.
- d. Auditory openings found on both sides of the front tibiæ.
- e. Ovipositor straight, long, and slender, the valves acutely dentate or obtuse. . . . . *Podoscirtus* Serville.
- ee. Ovipositor short, depressed, sublamellar, valves flattened.  
*Helerecons* Saussure.
- dd. Anterior tibiæ provided with a single auditory opening. Tegmina, when present, fully developed, elongate, the median vein branched.
- e. Auditory opening located on the inner side of the anterior tibiæ.
- f. Body normal. Head short, somewhat elevated. Pronotum rather short, wider than long, its posterior margin bisinuate, the canthi more or less conspicuous. Ovipositor slender, not flattened from above. . . . . *Aphonomorphus* Rehn.
- ff. Body slender, cylindrical. Head prominent, elongate, and elevated. Pronotum also elongate, cylindrical, the hind margin transverse, subarcuate, without canthi. Ovipositor flattened. . . . . *Stenaphonus* Saussure.
- ee. Auditory opening placed on the outer side of the anterior tibiæ.  
*Anaudus* Saussure.

- cc. Anterior tibiae without auditory openings on either side.<sup>1</sup>  
 d. Body provided with wings.  
   e. Tegmina regularly veined. . . . . *Tafalisca* Walker.  
   ee. Tegmina irregularly veined. . . . . *Nessa* Walker.  
 dd. Body apterous or subapterous. . . . . *Parametrypa* Brunner.

### Genus CYLINDROGRYLLUS Saussure.

*Cylindrogryllus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 556; KIRBY, Syn. Cat. Orth., II (1906), p. 92.

This genus, which is known by a single species, seems to be confined to Brazil. Just what its habits are seems to be doubtful, otherwise it is possible that more material would be available for study.

### 92. *Cylindrogryllus brevipennis* Saussure.

*Cylindrogryllus brevipennis* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 557; KIRBY, l. c.

*Habitat*.—The collections made by H. H. Smith in April at Chapada, Brazil, contain two female specimens of a small gryllid, which run to the genus *Cylindrogryllus* of Saussure. Since but a single species of the genus is known, and these specimens agree fairly well with the characterization of *C. brevipennis*, as given by Saussure, they are referred to it. As long as the male alone was described, the subjoined brief description of the female is now added.

Rather small, cylindrical, slender, entirely destitute of tegmina and wings, entire body together with the legs rather closely pubescent, pale brunneo-ferruginous, the legs and underside a little paler. Head large, wider than the anterior margin of the pronotum, the eyes prominent, but not exceptionally large, fully twice as far apart as their diameter; the front rather broadly rostrate and roundly protuberant; ocelli inconspicuous, the anterior one situated in a depression, located on a line drawn from the superior edges of the antennal scrobes. Pronotum cylindrical, nearly twice as long as broad, the anterior and posterior edges provided with a rather heavy border, very gently but roundly emarginate at its middle. Abdomen long and slender, gently fusiform; ovipositor moderately robust, gently arcuate, the apex spear-shaped with the lateral edges faintly crenulate. Hind femora moderately robust; metatarsus provided at its sides above with 2 : 3 short coarse spines or teeth.

<sup>1</sup> Possibly this entire section should be referred to the preceding family. If so, it would fall in the section AA.—*The author*.

Length of body, ♀, 12 mm.; of pronotum, 3.4 mm.; of hind femora, 10 mm., of ovipositor, 9 mm.

These specimens belong to the Carnegie Museum.

#### Genus PHYLLOGRILLUS Saussure.

*Phyllogrillus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 558; Biol. Cent.-Amer. Orth., I (1897), p. 257; KIRBY, Syn. Cat. Orth., II (1906), p. 92.

The present genus seems to be confined to tropical South America and presumably contains several species. But two are recognized in Kirby's Synonymic Catalog of the Orthoptera since he unites a couple of the described forms.

#### 93. *Phyllogrillus velutinus* (Walker)?

*Platydictylus velutinus* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 77.

*Eneoptera* (?) *velutina* SAUSSURE, Miss. Mex., Orth. (1874), p. 485.

*Phyllogrillus mortuifolia* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 559, Pl. 18 (LXI), figs. 1-5; Biol. Cent.-Amer. Orth., I (1897), p. 257; KIRBY, Syn. Cat. Orth., II (1906), p. 92.

*Habitat*.—Four females and three males together with five nymphs of an insect which in a measure agree with Walker's characterization of *velutinus* are referred to this species. These insects were taken at Chapada, Brazil, during the months of August and September (H. H. Smith). In addition to these I find two males labeled "Rio Guaporé, below the Rio São Miguel, Brazil, Aug. 22, 1909 (Haseman)." These latter bear a general resemblance to the Chapada specimens, but differ materially in several respects both as to structure and coloration.

It is barely possible, therefore, that we have at least two species here. The *P. mortuifolia* Saussure from Cayenne is larger than our specimens, while the *P. pipilans* Saussure is undoubtedly distinct from the others, thus suggesting at least four species. At present, however, I shall not attempt to separate these forms any further, leaving this for the future, when more material shall have been accumulated.

#### Genus DIATRYPA Saussure.

*Diatrypa* SAUSSURE, Miss. Mex., Orth. (1874), p. 476; KIRBY, Syn. Cat. Orth., II, (1906), p. 92.

*Diatrypus* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 561; Biol. Cent.-Amer. Orth., I (1897), p. 259; CHOPARD, Ann. Soc. Ent. France, LXXXI (1912), p. 414.

The crickets, which are referred to the genus *Diatrypa*, with few

exceptions are the smallest of the American Podoscirtidæ and are generally slender insects. The genus contains upwards of a dozen described species. No doubt there are a number of others still to be met with in tropical South American countries, when more general and careful collecting shall have been done. Some of the species are plain testaceous throughout, while others are variegated, and at least one is deep steel-blue in color. I shall not attempt to tabulate them now since the present paper is already too extended.

94. *Diatrypa colombiana* sp. nov.

Somewhat hirsute, especially the head and pronotum. A trifle above the average in size. A slender, fusco-testaceous insect, with the occiput, most of the lateral lobes of the pronotum, and the median vein of the tegmina dark fuscous or piceous. Head short, the eyes prominent, separated in front by a distance about equal to their greatest diameter, the rostrum scarcely as wide as one of the large basal antennal joints, gently sulcate. Pronotum narrowed gently forward, broader than long, the lateral lobes moderately high and with the lower margin broadly rounded; the anterior edge straight, the posterior margin broadly sinuose. Tegmina elongate, narrow, the speculum elongate with its anterior end somewhat acuminate, the hind portion rounded and the middle crossed transversely by a single vein. Wings lengthily caudate, the apical portion slightly infuscated. Last ventral segment, or subgenital plate, moderately large, a little longer than broad, expanding apically and broadly bilobed.

Length of body, ♂, 10 mm., of pronotum, 2 mm.; width, 2.5 mm., length of tegmina, 10 mm., of wings, 13 mm., of hind femora, 6.5 mm.

*Habitat*.—Don Amo (2,000 ft.) Dept. Magdalena, Colombia (H. H. Smith), a single male, the property of the Carnegie Museum.

There are two other specimens of the genus at hand, also males. These are of about the same size, but vary in some of the structural characters as well as somewhat in their coloration. The one which approaches most closely to our type comes from the Province del Sara, Bolivia, 350 M. The other was taken at Santa Cruz de la Sierra, Bolivia, 450 M. Both were collected by J. Steinbach. The latter has two transverse veins on the speculum—possibly only an accident.

95. *Diatrypa tuberculata* Saussure?

*Diatrypa tuberculata* SAUSSURE, Miss. Mex., Orth. (1874), p. 479; KIRBY, Syn. Cat. Orth., II (1906), p. 93.

*Habitat*.—A single male and four females of a *Diatrypa* from Chapada and Corumbá, Brazil, are referred to Saussure's *tuberculata* with some doubt. They were taken during the months of March, April, September and October, presumably by H. H. Smith.

This species was originally described from Buenos Aires, Argentina.

96. *Diatrypa ornata* Saussure.

*Diatrypa ornata* SAUSSURE, Miss. Mex., Orth. (1874), p. 480; KIRBY, Syn. Cat. Orth., II (1906), p. 93.

*Habitat*.—I find a single female specimen belonging to the genus *Diatrypa*, which agrees in most respects with Saussure's description of *D. ornata*. Hence I am referring it to that species. The specimen before me does not have the rufous tinge about the head and pronotum, but has them entirely deep steel-blue. It bears the label "Along the Rio Guaporé, below Rio San Miguel, Brazil, Aug. 22, 1909 (Haseman)."

## Genus PARÆCANTHUS Saussure.

*Paræcanthus* SAUSSURE, Miss. Mex., Orth. (1874), p. 468; Mém. Soc. Genève. XXV (1878), p. 593; Biol. Cent.-Amer. Orth., I (1897), p. 261; KIRBY, Syn. Cat. Orth., II (1906), p. 96.

*Carsidava* WALKER, Cat. Derm. Salt. B. M., I (1869), p. 53.

*Paræcanthus* is still another American genus of the family Podoscirtidæ, which contains several described South American species. These insects bear a rather striking resemblance to representatives of both *Diatrypa* and *Orocharis*, but differ from them as shown in the synoptic key printed on a preceding page.

Only two specimens of this genus are represented among the collections now being studied. They are both males and represent quite widely separated localities. The smaller of the two comes from Pará, Brazil, and might possibly be the *Carsidava cinerascens* Walker, which Kirby (see Syn. Cat. Orth. II, p. 97) places in the present genus. It also agrees fairly well with the description of *P. vicinus* Chopard (Ann. Soc. Ent. France, LXXXI, pp. 420-421, 3 figs.) both in size and color. Since it lacks the anterior tibiæ it is unsafe to definitely locate it with the latter, and Walker's description is too incomplete



to permit of placing it there. The second specimen is decidedly larger, and seems to differ sufficiently from the described forms to warrant its description as a new species.

97. *Paræcanthus picipes* sp. nov.

Related to both *P. cinerascens* Walker and *P. vicinus* Chopard, but larger. Head, pronotum, and the greater part of the hind femora fulvous or dark ferruginous; the anterior and middle legs together with the apex of the hind femora and the hind tibiæ piceous, or pitch-black; other parts dirty testaceous. Head of moderate size, about as wide as the front edge of the pronotum; the eyes fairly prominent; the front rostrate, a little narrower than the broad basal antennal segment; the posterior ocelli large, the anterior one very small, almost obliterated, situated in a slight pit at the very apex. Pronotum a little longer than its anterior width, evenly broadening towards the base, the disc furnished with a median longitudinal impressed line and two lateral triangular patches as in *P. vicinus*; the front margin roundly truncate, the base subangulate, not sinuose. Tegmina large, a little longer than the abdomen, the tympanum a little longer than wide, subangulate both in front and behind; the oblique veins five in number, the mediastin vein twelve-branched. Wings caudate. Legs short, the anterior tibiæ inflated basally, and perforated on both sides in a similar fashion as figured for *P. vicinus*.

Length of body, ♂, 17 mm., of pronotum, 2.9 mm., width, 4.15 mm., length of tegmina, 15 mm., of wings, 19 mm., of hind femora, 8.5 mm., of hind tibiæ, 7 mm.

*Habitat*.—The type and only specimen at hand comes from Quatro Ojos, Dept. Sta. Cruz, Bolivia, where it was taken at an elevation of three hundred meters above sea-level, by J. Steinbach. It is in the collection of the Carnegie Museum and belongs to Accession No. 5059.

Genus *HAPITHUS* Uhler.

*Hapithus* UHLER, Proc. Ent. Soc. Philad., II (1864), p. 546; KIRBY, Syn. Cat. Orth., II (1906), p. 97.

*Apilthis* SAUSSURE, Miss. Mex., Orth. (1874), p. 486.

*Apilthes* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 603; Biol. Cent.-Amer. Orth., I (1897), p. 265; BLATCHLEY, Proc. Indiana Acad. Sci., 1891, pp. 128, 139.

*Labussa* WALKER, Cat. Deim. Selt. B. M., I (1869), p. 75.

The genus *Hapithus*, which is entirely American in its distribution, contains about a dozen species. These are distributed from southern

Brazil to about the fortieth degree of north latitude. They may be recognized by the characters described in the generic synopsis given on a preceding page. Less than one-half of the described forms are recorded from South American countries.

98. *Hapithus annulicornis* (Saussure)?

*Apithis annulicornis* SAUSSURE, Miss. Mex., Orth. (1874), p. 491; Kirby, Syn. Cat. Orth., II (1906), p. 98.

*Habitat*.—A single female specimen taken during the month of November is referred to this species, though with some doubt. It comes from Chapada, Brazil (H. H. Smith).

Genus *OROCHARIS* Uhler.

*Orocharis* UHLER, Proc. Ent. Soc. Philad., II (1864), p. 544; SAUSSURE, Miss. Mex., Orth. (1874), p. 492; Mém. Soc. Genève, XXV (1878), p. 609; Biol. Cent.-Amer., Orth., I (1897), p. 269; BLATCHLEY, Proc. Indiana Acad. Sci., 1891, pp. 128, 139.

Like the preceding genus, *Orocharis* is confined to America, and has about the same distribution northward. To the southward it reaches well into Argentina. About two dozen species have been described. They differ materially from *Hapithus* in their more elongate and slender form, reminding one of the representatives of the genus *Metrypa*, from the males of which they may be separated by the incomplete oblique veins of the elytra and from the females by the form of the apical valves of the ovipositor.

99. *Orocharis saulcyi* (Guerin).

*Platydictylus saulcyi* GUERIN, Icon. R. Anim., Ins. (1844), p. 330.

*Orocharis saulcyi* SAUSSURE, Miss. Mex., Orth. (1874), p. 498; Kirby, Syn. Cat. Orth., II (1906), p. 98.

*Habitat*.—There is a single female specimen at hand bearing the labels "Jamaica, W. I." and "Carn. Mus. Acc. 2306."

Genus *APHONOMORPHUS* Rehn.

*Aphonomorphus* REHN, Ent. News, XIV (1903), p. 260; Kirby, Syn. Cat. Orth. II, (1906), p. 105.

*Aphonus* SAUSSURE, (*non* Leconte), Miss. Mex., Orth. (1874), p. 509; Mém. Soc. Genève, XXV (1878), p. 656; Biol. Cent.-Amer., Orth., I (1897), p. 280.

*Aphonogryllus* REHN (*nec* Perkins), Can. Ent. XXXIII (1901), p. 272.

*Eneoptera* DE HAAN (*nec* Burmeister), TEMMINCK, Verhandel. Orth. (1842), p. 231; Walker, Cat. Derm. Salt. B. M., I (1869), p. 66.

The insects, which are referred to the present genus, are distributed over the tropical portions of America, Africa, and the Oriental Region. The various species have a general resemblance one to another, but may be separated by such characters as size, color, and the form of the last ventral segment of the male abdomen, which latter is greatly developed into a scoop-like or spade-like prolongation. Upward of a dozen species have already been recognized in Central and South American countries, and now three others are added. The following table will aid in separating the American forms.

SYNOPSIS OF TROPICAL AMERICAN SPECIES OF APHONOMORPHUS.

- A. Auditory opening of the anterior tibiæ, oblong or elliptical.
  - b. Last joint of the maxillary palpi hatchet-shaped, usually with one side more expanded than the other, the apex often obliquely truncated. Eyes very prominent.
  - c. Ocelli of moderate size. Apex of the vertex concolorous (17 to 23 mm. in length).
    - d. Smaller (17 mm. in length), body not depressed. Posterior metatarsus armed with normal teeth or spines [Guiana and Brazil].  
*mutus* Saussure.
    - dd. Larger (22-23 mm.); the posterior metatarsus armed with large spines or teeth.
      - e. Posterior margin of the pronotum decidedly angulate at its middle. [French Guiana].....*variegatus* Chapard.
      - ee. Posterior margin of the pronotum broadly rounded at its middle.
        - f. Cinereous punctulate with fuscous. Median vein five-branched [Bolivia].....*silens* Saussure.
        - ff. General color rufo-testaceous. Median vein of the tegmina seven-branched. [French Guiana].....*major* Chapard.
    - cc. Ocelli very large, the middle one transverse. Apex of the vertex and of the front above yellow [Mexico].....*flavifrons* Saussure.
  - bb. Last joint of the maxillary palpi funnel-shaped, equally expanded on both sides of the middle, the apex not decidedly obliquely truncated. Eyes variable.
    - c. Tegmina, body, and legs varied with fuscous spots, patches, and lines.
      - d. Body moderately graceful, subcylindrical, not depressed. Head above and the pronotum marked with castaneous.
        - e. Hind tibiæ rather sparsely spined externally, internally five-spined [Colombia].....*timidus* Saussure.
        - ee. Hind tibiæ more numerous spined, externally seven-, internally nine-spined. [Bolivia].....*conspersus* sp. nov.
      - dd. Body not especially slender, somewhat depressed. Head above and the pronotum not prominently marked with castaneous or brown.

- e.* General color griseous. Discoidal vein of the tegmina alone spotted with black. [French Guiana] ..... *griseus* Chopard.
- cc.* General color fusco-testaceous. The tegmina throughout punctured or conspersed with fuscous. [Peru, Brazil] *telskii* Chopard.
- cc.* Tegmina body and legs not conspersed with fuscous.
- d.* Size smaller (17-18 mm.). General color ochraceo-testaceous, body weakly pubescent. [Guiana]..... *testaceus* Chopard.
- dd.* Size larger (19-20 mm.). General color ferruginous.
- e.* Tegmina provided with five prominent oblique ferruginous bands which follow the oblique veins. Wings lengthily caudate. [Bolivia]..... *obliquus* sp. nov.
- ee.* Tegmina without the oblique color-bands; wings not lengthily caudate. [Nicaragua]..... *diversus* Walker.
- AA.* Auditory opening of the anterior tibiae narrow, cleft-like.
- b.* Size larger (length of body 18 mm.).
- c.* Tegmina and wings very long, general color fulvo-testaceous [Peru]. *peruvianus* Saussure.
- cc.* Tegmina and wings shorter, the latter but little longer than the former. General color pale testaceous; the abdomen fuscous. [Brazil] *lividus* Burmeister.
- bb.* Size smaller (length about 13 mm.). Brunneo-testaceous, the abdomen dark fuscous. Humeral angle of the tegmina and pronotum vittate with flavous, bordered below by fuscous. [Brazil, Bolivia]. *hapitheformis* sp. nov.

#### 100. *Aphonomorphus mutus* (Saussure).

*Aphonus mutus* SAUSSURE, Miss. Mex., Orth. (1874), p. 510.

*Aphonomorphus mutus* KIRBY, Syn. Cat. Orth., II (1906), p. 106.

*Habitat.*—Three specimens are referred to this species. They are one male, one female from Rio de Janeiro, taken during October, and a female from Chapada, Brazil, also collected during the same month (H. H. Smith).

#### 101. *Aphonomorphus silens* (Saussure).

*Aphonus silens* SAUSSURE, Mém. Soc. Genève, XXV (1878), p. 665.

*Aphonomorphus silens* KIRBY, Syn. Cat. Orth., II (1906), p. 106.

*Habitat.*—There is a single male specimen of this species among the insects collected in the Province del Sara, Bolivia, at an elevation of 350 meters above sea-level. It was taken in December, 1912, by J. Steinbach. Carnegie Mus. Accession 5058.

#### 102. *Aphonomorphus conspersus* sp. nov.

A large but comparatively slender insect with the subgenital plate fashioned something like that of *A. major* Chopard. Strongly hirsute.

General color pale cinereo-testaceous sparsely conspersed on the pronotum, the humeral angle of the tegmina, and the hind femora with dark brown or fuscous spots.

Head a little broader than the anterior margin of the pronotum, gently depressed, the rostrum squarely truncate in front; eyes large and prominent; ocelli very large, almost touching one another. Apical joint of the maxillary palpi broadly funnel-shaped. Pronotum nearly as long as its basal width, the anterior margin shallowly but roundly emarginate, the posterior margin strongly sinuose. Tegmina narrow, extending well beyond the tip of the abdomen, the median vein eight-branched. Wings lengthily caudate. Anterior and middle legs rather robust, the front tibiae somewhat inflated and provided internally with a large oblong foramen. Hind femora graceful. Last ventral segment, or subgenital plate, fully twice as long as broad, longitudinally channeled at middle, the apex deeply and triangularly fissured, the two lobes evenly narrowed and rounded at their apex. Hind tibiae very irregularly spined, not normal in this specimen. Posterior metatarsus externally three-spined, internally one-spined, the apical spines very large and robust.

Length of body, ♂, 21 mm., including elytra, 25 mm., including wings, 30 mm., of tegmina, 21 mm., of pronotum, 3 mm., width 3.75 mm., length of hind femora, 13 mm.

*Habitat*.—The type, and only specimen, comes from "Sta. Cruz. de la Sierra, Bolivia," where it was taken at an elevation of 450 meters above sea-level by J. Steinbach. Carnegie Accession No. 4546.

103. **Aphonomorphus obliquus** sp. nov.

Related to *A. major*, but decidedly smaller, and less robust in form. A rufo-testaceous insect, with four prominently oblique rufous bands on the dorsal field of the tegmina. Body hirsute, in part also sericeous.

Head moderately large, a little wider than the front edge of the pronotum, depressed between the eyes, which are fairly prominent; ocelli large, elliptical, almost touching, and arranged in an arcuate row between the inner angles of the eyes. Pronotum transverse, strongly hirsute, the anterior end widely emarginate in front, behind roundly produced at middle, lateral lobes high, the lower margin rounded. Tegmina of moderate width, reaching beyond the apex of the abdomen and the tips of the hind femora, the veins rather numer-



ous and ferruginous, prominent, the cross-veins arranged in such a manner as to form four series of diagonal ones which give to these members the appearance of being crossed by that many oblique ferruginous bands, the median vein seven- or eight-branched; wings caudate, their apical field somewhat infuscated. Hind femora slender, unicolorous; hind tibiæ externally six-, internally eight-spined; posterior metatarsus one- to two-spined, anterior and middle legs rather slender, the front tibiæ a little swollen and perforated internally by an elliptical foramen. Subgenital plate elongate, the sides parallel, longitudinally and broadly canaliculate beyond the middle, the apex widely and shallowly emarginate. Cerci rather robust, curved, and about the length of the hind femora.

Length of body, ♂, 20 mm., to tip of tegmina, 22.5 mm., to tip of wings, 26 mm., of pronotum, 2.9 mm., width, 4 mm., length of hind femora, 11 mm.

*Habitat*.—The only specimen at hand, the type, comes from Santa Cruz de la Sierra, Bolivia, where it was collected by J. Steinbach at an elevation of 450 meters above sea-level. Carnegie Museum Accession No. 4546.

#### 104. *Aphonomorphus hapitheformis* sp. nov.

Body somewhat hirsute and sericeous. Of medium size, but comparatively robust, and having a rather strong resemblance to a fully winged female *Hapithes*. Bruneo-testaceous with a narrow testaceous line along each side of the pronotum and the humeral angles of the tegmina, and bordered below by dark brown, inclining to piceous. Abdomen piceous or black. Base of the tegmina conspicuously marked with a black spot.

Head of moderate size, semiglobose, the occiput tumid, gently depressed just back of, and between, the lateral ocelli. These medium in size, elliptical; rostrum rather prominent between the antennæ, of about the same width as the greatest diameter of the basal joint of the latter. Pronotum transverse, the humeral angles rounded, broadly emarginate in front, behind sinuose, the middle apex subangulate. Tegmina rather broad, a trifle longer than the abdomen, regularly veined in the female, a little irregularly so in the male, mediastine vein five-branched. Wings briefly caudate, slightly infuscated apically. Anterior and middle femora robust, the front tibiæ

but little inflated, the auditory opening small and narrow, fusiform or subfusiform. Hind femora robust and rather long for the size of the insect. Last ventral segment of the male abdomen elongate, evenly tapering apically, scarcely canaliculate, its apex roundly docked. Hind tibiæ five-spined on both sides; the posterior metatarsus one- to two-spined, or toothed.

Length of body, ♂, 12 mm., ♀, 13.5 mm.; of pronotum, ♂, 2.15 mm., ♀, 2.65 mm.; width, ♂, 3.25 mm., ♀, 3.4 mm.; length of tegmina, ♂, 12.5 mm., ♀, 13.5 mm.; of wings, ♂, 15 mm., ♀, 16 mm.; of hind femora, ♂, 12 mm., ♀, 13 mm.; of ovipositor, 9.5 mm.

*Habitat*.—Seven males and six females. These insects were taken at Chapada and Corumbá, Brazil, during the months of March to November (H. H. Smith) and Puerto Suarez, Bolivia, Nov.—Jan., 1908–1909 (J. Steinbach). The types, male and female, are deposited in the Carnegie Museum.

## XVI. A PRELIMINARY CATALOG OF THE NORTH AMERICAN SPHÆRIIDÆ.

BY VICTOR STERKI, M.D.

A monographic revision of the North American Sphæriidæ has long been demanded. Interest in this group of mollusks is steadily increasing. Nevertheless the way is not yet clear for preparing such a work in an entirely satisfactory manner. Much is still to be learned concerning the limits of some species, their trend and extent of variation, their interrelations, and relations to those of other zoögeographical provinces, and their resultant grouping and distribution. Furthermore in some cases we need to ascertain more details of a morphological and anatomical nature, and of the stages of development. More good material from all over the continent is still desirable, especially from those regions where little or no collecting has taken place. More specimens of the fossil species are also needed, especially from the Tertiaries and still older formations, in order that the phylogeny and geological history of the various species may at least to some extent be elucidated.

The study of this intricate group of mollusks is rendered especially difficult and peculiarly interesting by the great, and in some species apparently almost endless, variation which occurs. It may be in order to state in this connection that injudicious and haphazard "lumping" has done more to bring about difficulties than has been caused by minute discrimination between forms. The careful differentiation of forms alone enables us to determine their natural interrelations and affinities. Some forms of distinct species may resemble each other closely; while on the other hand forms of one species may be so different from each other, that at first glance they appear to belong to widely different species.

An essential factor in evolution is the influence of habitat. The Sphæriidæ furnish some very interesting illustrations of variation under the influence of environment. It is therefore very desirable, if not indispensable, to have specimens accompanied by accurate data as to the nature of the localities from which they are derived.

As has been stated above, the Nearctic Sphæriid fauna is still very imperfectly known; yet the material now at hand proves it to be surprisingly rich in groups, species, and forms, when compared with what was known some years ago. It is much more so than the Palearctic, a fact which is explained by the geological history of the continent. The two faunas are more closely related than has been supposed, *e. g.*, by Clessin; the genera are the same in both, quite a number of species are identical, and others are at least close relatives. More evidence in that direction may come to light when the vast territory of British America is better explored, being in the same latitude as middle and northern Europe.

The metropolis of the Nearctic Sphæriidæ is the region of the Great Lakes, where they have attained the greatest number of species and the widest diversity of forms. The East, and more so the West, have a number of species and forms of their own, which present some apparently difficult problems of distribution. The South has some species which show relations to the faunas of the West Indian islands and of Central and South America.

The fauna of our Great Lakes themselves is only fragmentarily known, so far as the Sphæriidæ are concerned, strange as it may appear. To judge from the material at hand, from a few places on Lakes Michigan and Erie, and from very little dredging, there are many peculiar forms, and possibly species. It is hoped that systematic collecting may be done at many places, so that it may be possible to ascertain the relations of the forms from the lake-region with the species and forms from other regions and also to compare the faunas of the several lakes.

In the following catalog an attempt is made to give a survey of our knowledge of the group so far as this can be effected by a mere list. To the species cited from previous literature a few new ones are added, together with some varieties, most of which were established and named years ago. It may be added that there are numerous forms in the hands of the writer, which could not be referred to any of the established species. With additional material for comparison, the affinities of these will eventually be ascertained.

With every species citation is made of the publication in which it was originally described. Other papers, some of which are more easily accessible, or which are desirable for reference in order to a better understanding of the species, are also in some cases cited.

Synonyms are added only as they appear to be necessary for identification. Distribution is given in a general way by states and provinces. Fossil species cited in the same way must be understood as having been obtained from marl and glacial and post-glacial deposits. The numbers of the entries cited refer to the collection of the Sphæriidæ in the Carnegie Museum, unless otherwise stated. An alphabetical list has been added for use in checking and as an index.

A few directions for collecting and handling material are given with a view to making this work easier and more successful on the part of those who are doing field-work. These directions are embodied in a brief article which immediately succeeds the present catalog in the order of publication. Reprints of this article will be supplied by the author or by the director of the Carnegie Museum to those who may desire information as to the best manner of collecting the smaller mollusca, and especially to those who may wish to aid the Museum in making its collections complete.

Thanks are extended by the writer to the many malacologists, who, by making collections, or by loaning specimens, have aided him in his researches. A list of these, together with an account of their work will be published in a forthcoming monograph, but the writer cannot refrain from here mentioning his special indebtedness to Dr. Bryant Walker of Detroit, Michigan, for his many favors and the literary references which he has given him.

The following abbreviations are employed throughout this paper: *Boston Proc.* for "Proceedings of the Boston Society of Natural History"; *Mon. Corb.* for "Monograph of the North American Corbiculadæ," by Temple Prime, Smithsonian Miscellaneous Collections, 1865.

### Family SPHÆRIIDÆ.

#### Genus SPHÆRIUM Scopoli.

##### I. *Sphærium sulcatum* (Lamarck).

*Cyclas sulcata* LAMARCK, *An. sans Vert.*, V, 1818, p. 560.

*Cyclas similis* SAY, *Nicholson's Encycl. Ed. IX*, 1818 (?), Pl. I, fig. 9.

*Sphærium sulcatum* PRIME, *Mon. Corb.*, p. 33.

*Habitat.*—East of the Rocky Mountains, rare in the South.

*Fossil.*—Maine, New Jersey, Ohio, Michigan, Illinois.



2. **Sphærium sulcatum albescens** var. nov.

Straw-colored to whitish in young and half-grown specimens; darker, somewhat grayish-corneous in old specimens. Superior and inferior margins little curved; beaks rather narrow, and somewhat anterior; striæ fine and crowded; hinge slight. A well-marked variety, somewhat variable.

*Habitat*.—Maine, Massachusetts, eastern New York.

3. **Sphærium sulcatum insigne** var. nov.

Larger, some specimens attaining 23 mm. in length, more elongate, well inflated; superior and inferior margins little curved; anterior and posterior ends rounded; beaks somewhat anterior, rather narrow, and slightly prominent; surface striæ fine, crowded; straw-colored, light corneous around the beaks; shell and hinge slight.

*Habitat*.—Grand Rapids, Michigan.

Specimens are found in the Cincinnati Museum obtained from Cope, and ticketed "No. 5088." Some good specimens are also in the American Museum of Natural History, possibly from the same place (source and locality not indicated on label). This form is remarkable for its size, shape, and color.

4. **Sphærium sulcatum planatum** var. nov.

Smaller than common, or typical, *sulcatum*, more inequipartite, the beaks being markedly anterior; less inflated, especially flattened over the lower parts of the valves, more truncate anteriorly and posteriorly, inferior margin less curved; beaks narrower and little elevated; surface striæ slighter; shell and hinge slighter. Extreme forms are so very different as to appear distinct, but there are intermediates.

*Habitat*.—Ohio, Indiana, Illinois, Michigan, Ontario.

*Fossil*.—Ohio.

5. **Sphærium crassum** Sterki.

*Nautilus*, XIV, 1901, p. 140.

Most examples are larger, more elongate, and more inequipartite than the original types from Michigan.

*Habitat*.—Northern New York, Quebec, Ontario, northern Michigan, Minnesota.

6. **Sphærium aureum** (Prime).

*Cyclas aurea* PRIME, *Boston Proc.*, IV, 1851, p. 159.

*Spharium aureum* PRIME, *Mon. Corb.*, 1865, p. 35.

Few adult or adolescent specimens are of a "bright golden" color and not many are "greenish yellow," as is said in Prime's description; generally they are light to dark corneous, or grayish. Specimens of various other *Sphæria* have been named "*aureum*" on account of their yellow color.

*Habitat*.—The original specimens were supposed to be from Lake Superior; apparently the same *Sphærium* is found in the Upper Mississippi Valley, in Illinois, Iowa, South Dakota, Missouri, and as far east as northwestern Ohio. A somewhat different form, but probably not distinct, comes from southern Missouri, Arkansas, and Kansas.

7. *Sphærium lineatum* Sterki.

*Nautilus*, XXIII, 1910, p. 142.

*Habitat*.—Indiana, Illinois, Michigan.

8. *Sphærium solidulum* (Prime).

*Cyclas solidula* PRIME, *Boston Proc.*, 1851, p. 158.

*Sphærium solidulum* PRIME, *Mon. Corb.*, 1865, p. 36.

*Habitat*.—Mississippi Valley and eastward; very variable and not yet clearly definable, though good material from many places is at hand. Typical and near-typical forms occur in Ohio, Indiana, Illinois, Michigan, and Kentucky, in rivers and creeks. From Ohio eastward it becomes apparently scarcer, and is represented by smaller forms, some of them barely recognizable. Westward (Iowa) and southward (Alabama) there are found other different, yet apparently conspecific forms, more elongate, with finer striæ, and slighter shells and hinges. A peculiar lacustrine form from Lake Michigan may be of this species, though of a very different shape.

*Fossil*.—Ohio.

9. *Sphærium stamineum* (Conrad).

*Cyclas staminea* CONRAD, *American Journ. Sci.*, XXV, 1834, p. 342.

*Sphærium stamineum* PRIME, *Mon. Corb.*, 1865, p. 38.

Very variable, more so than any other species, and several extreme forms appear to be distinct. It is rather a "form-cycle" than a species in the current sense.

*Habitat*.—Mississippi Valley and eastward (rare east of the Appalachians); Manitoba.

*Fossil*.—New York, Ohio, Michigan, Illinois.

10. *Sphærium stamineum forbesi* Baker.

*Nautilus*, XXII, 1906, p. 21.

*Habitat*.—Illinois, Michigan, Ohio River at Cincinnati, Maryland, and Virginia.

11. *Sphærium stamineum wisconsinense* var. nov.

Smaller than average *stamineum*, not so high, less inflated, superior margin less curved; surface striæ moderately coarse to obsolete; color light corneous to grayish; shell and hinge slighter.

*Habitat*.—Wisconsin, Michigan.

*Fossil*.—Illinois, post-glacial deposits of Chicago.

12. *Sphærium emarginatum* (Prime).

*Cyclas emarginata* PRIME, *Boston Proc.*, IV, 1851, p. 156.

*Sphærium emarginatum* PRIME, *Mon. Corb.*, 1865, p. 43.

*Habitat*.—Maine to Lake Superior, Winnipeg, Keewatin.

13. *Sphærium torsum* sp. nov.

Mussel inequipartite, oblique, well-inflated, posterior part higher, and much more voluminous than the anterior; dorso-ventral axis curved and oblique; beaks strongly inclined forward, large, prominent, rounded, not, or slightly, mamillar; superior margin curved, not, or barely, bounded by angles; scutum and scutellum well marked; anterior and posterior ends rounded, inferior margin moderately curved; surface with fine, slight, irregular or subregular concentric striæ and a few lines of growth, shining; yellow, straw-colored in younger specimens; shell moderately strong; hinge long for the shape and size of the mussel, almost regularly curved, rather slight; cardinal teeth small, the left posterior tooth vestigial in some specimens; laminae rather slight, at almost a right angle to each other; ligament covered, resilium moderately strong. Soft parts not examined. Long. 11 mm.; alt. 9 mm.; diam. 7 mm. (100 : 83 : 64).

*S. torsum* appears to range near *emarginatum* of the same region, but is more oblique, of more rounded outlines, more evenly inflated. The beaks are less elevated, less mamillar, and more inclined forward, and the hinge is much slighter.

*Habitat*.—Quebec, Ontario, along the Ottawa River near Hull and Ottawa, collected by Justice F. R. Latchford, 1911 and 1912. Types in the collection of Mr. Latchford, and No. 6956 for full-grown, and 7286 for young and adolescent specimens. It occurs also in Wisconsin.

*Fossil*.—Goat Island, Niagara, collected by Miss J. E. Letson, 1900 (No. 2224a).

14. **Sphærium acuminatum** (Prime).

*Cyclas acuminata* PRIME, *Boston Proc.*, IV, 1851, p. 155; synonym of *Sphærium striatinum*, *Mon. Corb.*, 1865, p. 37. Cf. *Nautilus*, XXVI, 1913, p. 139.

It should be stated in addition to the foregoing synonymy that T. Prime himself acknowledged *C. acuminata* as a species, and *C. albula* as a synonym for it in a catalog of 1853.

*Habitat*.—Region of the Great Lakes, common and variable.

*Fossil*.—Illinois.

15. **Sphærium vermontanum** Prime.

*Sphærium vermontanum* PRIME, *Proc. Acad. Nat. Sci. Philada.*, 1861, p. 128; *Mon. Corb.*, 1865, p. 42.

*Habitat*.—Lakes Champlain and Nephremagog, Vermont, according to Prime. The species is insufficiently known. In July, 1914, Mr. William F. Clapp collected a large number of specimens in Lake Champlain near Chimney Point, Vermont, by dredging, and these appear to belong to the present species, but do not quite agree with Prime's description and figure, being smaller, less inflated, and with the beaks not so prominent. They may represent a lacustrine form. Specimens which may belong to *S. vermontanum* have been seen from Maine, Quebec, and Ontario.

16. **Sphærium striatinum** (Lamarck).

*Cyclas striatina* LAMARCK, *An. sans Vert.*, V, 1818, p. 560.

*Sphærium striatinum* PRIME, *Mon. Corb.*, 1865, p. 37. (Minus some synonyms.)

*Cyclas edentula* SAY, *teste* Prime.

Very variable, and still difficult to define as a species. Besides, almost every *Sphærium* has been named "*striatinum*," and there are many thus misidentified lots in collections.

*Habitat*.—East of the Rocky Mountains. The center of distribution appears to be in the Middle States, Ohio, Michigan, Indiana, and Illinois. Typical or near-typical forms have not been seen from the South.

*Fossil*.—Michigan, Illinois, Ohio.

17. **Sphærium striatinum corpulentum** var. nov.

Mussel large, high, well inflated, the surface often having rather coarse striæ; shell and hinge rather strong.

This appears to be the really typical form, rather than the small eastern mussel described by Prime in his *Monograph of the North American Corbiculadæ*. Prime's figure does not agree with the description nor with any specimens.

*Habitat*.—Michigan, Ohio, Illinois, mostly in creeks.

18. **Sphærium lilycashense** F. C. Baker.

*Sphærium lilycashense* F. C. BAKER, *Nautilus*, XII, 1898, p. 65.

*Habitat*.—Lilycash Creek, Joliet, Illinois; apparently also Chicago River, and Charlevoix, Michigan.

19. **Sphærium ohioëense** Sterki.

*Sphærium ohioëense* STERKI, *Nautilus*, XXVI, 1913, p. 139.

*Habitat*.—Ohio River in Ohio and Indiana; Elk River, West Virginia.

20. **Sphærium modestum** (Prime).

*Cyclas modesta* PRIME, *Boston Proc.*, IV, 1851, p. 159; as synonym of *S. striatinum* in *Mon. Corb.*, 1865, p. 37.

Appears to be distinct, and certainly is not identical with *S. striatinum* Lamarck.

*Habitat*.—New York to Virginia and westward; apparently occurring sporadically in Ontario, eastern Ohio, Kentucky, and Alabama.

21. **Sphærium flavum** (Prime).

*Cyclas flava* PRIME, *Boston Proc.*, IV, 1851, p. 155.

*Sphærium flavum* PRIME, *Mon. Corb.*, 1865, p. 43.

Variable.

*Habitat*.—Region of the Great Lakes.

22. **Sphærium fabale** (Prime).

*Cyclas fabalis* PRIME, *Boston Proc.*, IV, 1851, p. 159.

*Sphærium fabale* PRIME, *Mon. Corb.*, 1865, p. 40.

*Habitat*.—Eastern North America.

23. **Sphærium triangulare** (Say).

*Cyclas triangularis* SAY, *New Harmony Disseminator*, 1829, p. 356.

*Sphærium triangulare* PRIME, *Mon. Corb.*, 1865, p. 36.

*Sphærium triangulare* PILSBRY, *Proc. Acad. Nat. Sci. Philada.*, 1903, p. 785; Pl.

LIII, figs. 4, 4a, 3, 3a; Pl. LII, fig. 3.

*Habitat*.—Mexico, Colorado (?).



24. *Sphærium jalapense* Pilsbry.

*Sphærium jalapense* PILSBRY, *I. c.*, p. 786; Pl. LIII, figs. 1, 1a; Pl. LII, fig. 1.

*Habitat*.—Mexico, Texas.

25. *Sphærium pilsbryanum* Sterki.

*Sphærium pilsbryanum* STERKI, *Nautilus*, XXII, 1909, p. 141.

*Habitat*.—Bear Lake, Utah (originals fossil), recent in Utah Lake.

26. *Sphærium dentatum* (Haldeman).

*Cyclas dentata* HALDEMAN, *Proc. Acad. Nat. Sci. Philada.*, 1841, p. 100.

*Sphærium dentatum* PRIME, *Mon. Corb.*, 1865, p. 40.

The species is not sufficiently well known.

*Habitat*.—Oregon, Washington.

27. *Sphærium tumidum* Baird.

*Sphærium tumidum* BAIRD, *Proc. Zool. Soc. London*, 1863, p. 69.

*Sphærium tumidum* PRIME, *Mon. Corb.*, 1865, p. 43.

*Habitat*.—British Columbia, Sumass Prairie, Frazer River.

28. *Sphærium hendersoni* Sterki.

*Sphærium hendersoni* STERKI, *Nautilus*, XX, 1906, p. 69.

*Habitat*.—Colorado.

29. *Sphærium spokani* Baird.

*Sphærium spokani* BAIRD, *Proc. Zool. Soc. London*, 1863, p. 69.

*Sphærium spokani* PRIME, *Mon. Corb.*, 1865, p. 44.

*Habitat*.—British Columbia, Spokane and Kootenai Rivers.

30. *Sphærium californicum* Clessin.

*Sphærium californicum* CLESSIN, *Malacozoöl. Blätter*, XXV, 1878, p. 123, Pl. V, fig. 2; *Monograph Cycladeen* in Martini-Chemnitz, 1879, p. 270, Pl. 41, figs. 20 and 21.

*Habitat*.—California.

31. *Sphærium nobile* (Gould).

*Cyclas nobilis* GOULD, *Boston Proc.*, V, 1855, p. 229.

*Sphærium nobile* PRIME, *Mon. Corb.*, 1865, p. 41.

*Habitat*.—California and Washington.

32. *Sphærium primeanum* Clessin.

*Sphærium primeanum* CLESSIN, *Malacozoöl. Blätter*, XXV, 1878, p. 122, Pl. V, figs. a, b; *Monograph Cycladeen*, *I. c.*, 1879, p. 122, Pl. 41, figs. 18, 19.

*Habitat*.—Oregon, Washington.

33. *Sphærium patella* (Gould).

*Cyclas patella* GOULD, *Boston Proc.*, III, 1850, p. 292.

*Sphærium patella* PRIME, *Mon. Corb.*, 1865, p. 42.

*Habitat*.—Northern California to British Columbia.

34. *Sphærium rhomboideum* (Say).

*Cyclas rhomboidea* SAY, *Proc. Acad. Nat. Sci. Philada.*, 1822, p. 380.

*Sphærium rhomboideum* PRIME, *Mon. Corb.*, 1865, p. 39.

*Habitat*.—New England, and New York, thence to Wisconsin; Ontario; Manitoba; Alaska; British Columbia (?); Nevada (?).

*Fossil*.—Maine, Ohio, Michigan, Illinois.

35. *Sphærium occidentale* Prime.

*Cyclas ovalis* PRIME, *Boston Proc.*, IV, 1852, p. 276.

*Sphærium occidentale* PRIME, *Proc. Acad. Nat. Sci. Philada.*, 1860, p. 295; *Mon. Corb.*, 1865, p. 41.

*Habitat*.—Widely distributed over the continent, but as yet of doubtful occurrence in the southwestern states; apparently rare in the south.

*Fossil*.—This, or a species very close to it, occurs in the Miocene of North Carolina.

36. *Sphærium occidentale amphibium* Sterki.

*Sphærium occidentale amphibium* STERKI, *Proc. Ohio Acad. Sciences*, 1907, p. 395.

*Habitat*.—Extends over the same area as the preceding, but is apparently more northern in its distribution.

37. *Sphærium tenue* (Prime).

*Cyclas tenuis* PRIME, *Boston Proc.*, IV, 1851, p. 161.

*Sphærium tenue* PRIME, *Mon. Corb.*, 1865, p. 47.<sup>1</sup>

This *Sphærium* is one of our rarest and least known species. Mr. William F. Clapp in 1914 collected in Lake Champlain a number of specimens of a form larger than any seen before, 7.5 to 9 mm. long. The measurements are for example as follows: long. 8; alt. 6.5; diam. 4.5–4.8 mm. T. Prime in his *Monograph* gives the following measurements: "Long. 4.5; alt. 3; diam. 1.5 mm.," evidently being those of an immature example.

*Habitat*.—Lake Champlain, Ontario, Michigan, northern Indiana, Keewatin, Yukon Territory, Alaska.

<sup>1</sup> Placed in the "Calyculate Group" = *Musculium*.

38. *Sphærium tenue walkeri* Sterki.*Sphærium walkeri* STERKI, *Nautilus*, XIV, 1901, p. 141 (*partim*).

A small lacustrine, or deep-water, form, with the beaks broader and less elevated, as is generally the case in lake forms of *Sphæria*.

*Habitat*.—Dredged from Lake Michigan in water twenty-four meters deep. The form occurs also in Lake Michigan on the Indiana coast.

39. *Sphærium mormonicum* Sowerby.*Sphærium mormonicum* SOWERBY, *Con. Icon.*, fig. 44.

*Habitat*.—Cited as from Great Salt Lake. I have seen no specimens.

The following four fossil species from the Tertiaries of Nebraska, described at various times by Meek & Hayden, have not been seen by the writer, who includes them in this catalog, as cited by Prime in his Monograph. The last two may be species of *Musculium*.

40. *Sphærium recticardinale* Meek & Hayden.*Sphærium recticardinale* MEEK & HAYDEN, *Proc. Acad. Nat. Sci. Philada.*, 1860, p. 176.41. *Sphærium planum* Meek & Hayden.*Sphærium planum* MEEK & HAYDEN, *Proc. Acad. Nat. Sci. Philada.*, l. c., p. 175.42. *Cyclas formosa* Meek & Hayden.*Cyclas formosa* MEEK & HAYDEN, *Proc. Acad. Nat. Sci. Philada.*, 1856, p. 115.43. *Cyclas subelliptica* Meek & Hayden.*Cyclas subelliptica* MEEK & HAYDEN, *Proc. Acad. Nat. Sci. Philada.*, 1856, p. 115.

## Genus MUSCULIUM Link.

*Calyculina* Clessin.1. *Musculium elevatum* (Haldeman).*Cyclas elevata* HALDEMAN, *Proc. Acad. Nat. Sci. Philada.*, I, 1841, p. 53.*Sphærium elevatum* PRIME, *Mon. Corb.*, 1865, p. 44.

*Habitat*.—Georgia to Texas, Missouri, Illinois.

2. *Musculium orbiculare* Sterki.*Musculium orbiculare* STERKI, *Nautilus*, XXVI, 1913, p. 140.

*Habitat*.—Indiana, Illinois (originals), Louisiana, Texas, Minnesota (?). Cf. Roper, *Nautilus*, X, p. 29.

3. **Musculium contractum** (Prime).

*Sphærium contractum* PRIME, *Mon. Corb.*, 1865, p. 48.

Apparently near *M. elevatum*.

*Habitat*.—Alabama, Florida.

4. **Musculium hodgsoni** (Sterki).

*Calculina hodgsoni* STERKI, *Nautilus*, XVI, 1902, p. 91.

*Habitat*.—Ohio, Illinois, Missouri, Kansas, Louisiana, Iowa (the specimens from Iowa are different).

5. **Musculium transversum** (Say).

*Cyclas transversa* SAY, *New Harmony Disseminator*, II, 1829, p. 356.

*Sphærium transversum* PRIME, *Mon. Corb.*, 1865, p. 48.

*Sphærium martensi* PILSBRY, *Proc. Acad. Nat. Sci. Philada.*, 1899, p. 401; *l. c.*, 1903, p. 786, figs.

*Habitat*.—The continent to Mexico.

6. **Musculium transversum decisum** forma nova.

Mussel sharply truncate anteriorly and posteriorly in nearly straight lines; apparently smaller and less inflated.

*Habitat*.—Jackson, Alabama, in a pool near the Tombigbee River, collected by H. H. Smith. Specimens are contained in the collection of Mr. Bryant Walker, and are represented in the Carnegie Museum by No. 5164.

7. **Musculium subtransversum** (Prime).

*Sphærium subtransversum* PRIME, *Proc. Zoöl. Soc. London*, XXVIII, 1860, p. 322.

*Sphærium subtransversum* PILSBRY, *Proc. Acad. Nat. Sci. Philada.*, 1903, p. 787, Pl. LIII, figs. 6, 6a.

Appears to be distinct, judging by the description and figures given by Dr. Pilsbry and specimens. Specimens sent from Texas to collections under this name are *M. transversum*.

*Habitat*.—Mexico.

8. **Musculium ferrissi** (Sterki).

*Calculina ferrissi* STERKI, *Nautilus*, XVI, 1902, p. 91.

*Habitat*.—Oklahoma, Louisiana, Missouri, specimens from the latter locality having a somewhat different form.

9. **Musculium novoleonis** (Pilsbry).

*Sphærium novoleonis* PILSBRY, *Proc. Acad. Nat. Sci. Philada.*, 1903, p. 787, Pl. LIII, figs. 5, 5a; Pl. LIV, fig. 6.

*Habitat*.—Mexico.

10. **Musculium jayense** (Prime).*Cyclas jayensis* PRIME, *Boston Proc.*, IV, 1851, p. 157.*Sphærium jayanum* PRIME, *Mon. Corb.*, 1865, p. 46.*Habitat.*—Ohio to Dakota, Ontario, Manitoba, Alberta.11. **Musculium partumeium** (Say).*Cyclas partumeia* SAY, *Journal Acad. Nat. Sci. Philada.*, II, 1822, p. 380.*Sphærium partumeium* PRIME, *Mon. Corb.*, 1865, p. 45.

Very variable, and there appear to be some more or less well-marked varieties, besides those hereafter mentioned.

*Habitat.*—East of the Rocky Mountains, commoner in the northeast.12. **Musculium partumeium cœruleum** (Prime).*Cyclas cœrulea* PRIME, *Boston Proc.*, IV, 1851, p. 161.*Habitat.*—New England, New York.13. **Musculium partumeium globosum** var. nov.

Small, well inflated, with rounded, almost circular outlines.

## MEASUREMENTS.

Long. 8.3; alt. 7.5; diam. 5 mm. (100 : 90 : 60) Massachusetts.

Long. 7.3; alt. 6.8; diam. 5 mm. (100 : 93 : 68) Ohio.

*Habitat.*—Duxbury, Massachusetts, collected by Mr. William F. Clapp in 1913, specimens in the Museum of Comparative Zoölogy and in the Carnegie Museum, No. 7885; Rhode Island; Garrettsville, Ohio, collected by Mr. George J. Streator, 1900, Carnegie Museum, No. 1914. All specimens from whatever locality are markedly uniform.

14. **Musculium partumeium mirabile** (Prime).

*Cyclas mirabilis* PRIME, *Boston Proc.*, IV, 1851, p. 157; treated in the *Monograph of the Corbiculadæ* as a synonym of *Sphærium partumeium*.

*Habitat.*—Georgia, Florida.15. **Musculium partumeium eburneum** (Anthony).

*Cyclas eburnea* ANTHONY, *Boston Proc.*, IV, 1852, p. 279. Synonym of *Sphærium partumeium* PRIME, *Mon. Corb.*

*Habitat.*—Arkansas.16. **Musculium truncatum** (Linsley).*Cyclas truncata* LINSLEY, *Am. Jour. Sci.*, VI, 1848, p. 234, fig. 3.*Cyclas pellucida* PRIME, *Boston Proc.*, IV, 1851, p. 277.*Sphærium truncatum* PRIME, *Mon. Corb.*, 1865, p. 51.



Very variable. There are some doubtful forms, which may, or may not, belong to this species.

*Habitat*.—East of the Rocky Mountains, occurring most commonly from New York to Illinois. It is apparently rare, if occurring at all, in the south.

*Fossil*.—Ohio, Michigan.

17. ***Musculium truncatum albidum*** var. nov.

Mussel of moderate size, with more rounded outlines; surface striæ very slight; shell more or less whitish, translucent to opaque.

*Habitat*.—New York to Illinois.

18. ***Musculium truncatum angustatum*** var. nov.

More oblique, more inequipartite, the posterior part markedly higher and larger than the anterior; beaks narrow, more elevated and more inclined forward; otherwise near *M. albidum*. The form, though possibly not of sufficiently wide distribution to constitute a subspecies, is interesting and significant, showing the trend of variation and affinities.

*Habitat*.—Canton, Illinois. There are a number of specimens in the American Museum of Natural History from the Crooke Collection, No. 17,800, and in the Carnegie Museum, No. 7,777.

19. ***Musculium lacustre*** (Müller).

*Tellina lacustris* MÜLLER, *Verm. Hist.*, II, 1774, p. 204, No. 388.

*Calyculina lacustris* CLESSIN, *Monogr. Cycladeen* in Martini-Chemnitz, p. 253, Pl. 41, figs. 9-12, 16, 17.

*Habitat*.—Palearctic and Nearctic Regions. Indiana, Ontario (and probably northward), California, Washington.

20. ***Musculium rosaceum*** (Prime).

*Cyclas rosacea* PRIME, *Boston Proc.*, IV, 1851, p. 155.

*Sphærium rosaceum* PRIME, *Mon. Corb.*, 1865, p. 50.

Very variable. *Sphærium deforme* H. F. Carpenter, is a deformed, pathological form of *M. rosaceum*. A very small *Musculium* from northern Ohio, Indiana, and Michigan, which has been taken for immature *M. rosaceum*, may be *M. ryckholti*, immature, or possibly distinct.

*Habitat*.—Maine to Virginia, Ontario, Ohio, and Illinois.

21. **Musculium rosaceum fuliginosum** var. nov.

Mussel small, rather short, subequipartite, moderately inflated, somewhat "pinched" along the margins; beaks nearly in the middle, narrow, somewhat prominent, calyculate; superior margin angular at the beaks, its anterior and posterior parts straight or nearly so, equally sloping; supero-anterior and posterior slopes, or truncations, well marked, nearly straight, the posterior longer and steeper, nearly at right angle with the longitudinal axis, anterior and posterior ends rounded; inferior margin moderately curved; surface shining and with a silky gloss derived from very narrow, membranous, scaly projections of the periostracum on the fine concentric striæ; shell very thin, glassy transparent, with a marked grayish or smoky hue.

The largest specimen measures: Long. 7; alt. 6; diam. 3.8 mm.

The mussel is striking in appearance and at first sight seems to be distinct, especially since all specimens are remarkably uniform, but young and adolescent individuals reveal features of other forms of *M. rosaceum*.

*Habitat*.—Scott Graham Creek, Carleton County, Ontario, collected by Mr. Justice F. R. Latchford, 1911 and 1913. Specimens are contained in his collection and in the Carnegie Museum, Nos. 6,945 and 7,431. Justice Latchford writes in November, 1913: "No. 2925 is quite common. I have visited the creek at all seasons and never found any larger shells than those which I send; I therefore regard them—the larger ones—as full-grown."

22. **Musculium declive** Sterki.

*Musculium declive* STERKI, *Nautilus*, XXV, 1912, p. 103.

*Habitat*.—Michigan, Ontario.

23. **Musculium ryckholti** (Normand).

*Cyclas ryckholti* NORMAND, *Notes sur Quelques Nouvelles Cyclades*, 1844, p. 7, figs. 5, 6.  
*Caliculina ryckholti* CLESSIN, *Monograph Cycladeen* in Martini-Chemnitz, 1897, p. 257, Pl. 40, figs. 20-27.

Very variable. Some of the forms appear to be the same as varieties described from Europe.

*Habitat*.—Palearctic and Nearctic Regions. Maine, Connecticut, Ontario, Michigan, Iowa, South Dakota, Montana, Idaho, and probably far northward.

*Musculium pusillum* Sterki, *cf. Nautilus*, XXIV, 1910, p. 3, is probably an immature form of *M. ryckholti*. The type came from Michigan.

24. **Musculium raymondi** (J. G. Cooper).

*Sphærium raymondi* COOPER, *Proc. Calif. Acad. Sciences* (2), III, 1892, p. 74.

Closely resembling *M. ryckholti*, and at least some forms ranged under it may belong to that species.

*Habitat*.—California (Sierra Nevada), Washington, British Columbia.

25. **Musculium winkleyi** Sterki.

*Musculium winkleyi* STERKI, *Nautilus*, XXIII, 1909, p. 66.

*Habitat*.—Maine, Massachusetts.

*Fossil*.—Maine.

26. **Musculium securis** (Prime).

*Cyclas securis* PRIME, *Boston Proc.*, IV, 1851, p. 160.

*Sphærium securis* PRIME, *Mon. Corb.*, 1865, p. 49.

Very variable. The form *æstivale* (cf. *The Nautilus*, XXIII, p. 18) is markedly different, and corresponding forms of most of the species of *Musculium* have been seen. The designation is applicable to each of them, since it is not a subspecific or varietal name.

*Habitat*.—East of the Rocky Mountains, but apparently rare in the South and wanting in the Gulf States; common in the Northeast; South Carolina.

*Fossil*.—Maine, Michigan.

27. **Musculium sphæricum** (Anthony).

*Cyclas sphærica* ANTHONY, *Boston Proc.*, IV, 1852, p. 275.

*Sphærium sphæricum* PRIME, *Mon. Corb.*, 1865, p. 50.

Rather variable. It appears that *M. sphæricum* is not specifically distinct from *M. securis* Prime, although typical forms are noticeably different from each other, they are inseparably and intricately connected by intermediate forms. Both are decidedly variable, yet the specimens from each habitat are fairly uniform; of both there are forms with calyculate and with plain, rounded beaks, "*æstivale*."

*Habitat*.—Northern Ohio and Indiana, Michigan, New York, New England, more common in the western part of the area.

28. **Musculium sphæricum succineum** var. nov.

Mussel somewhat smaller, less inequipartite; beaks rather large and full, the shell is translucent to transparent, of clear amber-color, the surface glossy, with very fine slight striæ, not scaly.

*Habitat*.—Agawam River at East Wareham, Massachusetts. Several hundred specimens were collected in 1908 by the Rev. H. W. Winkley, and are in his collection and in that of the Carnegie Museum, No. 5,346. Most of the specimens have the beaks plain, not calyculate. Specimens collected later at the same place by Mr. William F. Clapp are of the same shape and appearance, but smaller, and almost all are incrustated with a ferruginous deposit. Similar forms have been seen by the writer from Rhode Island, New York, and Ohio.

29. **Musculium parvum** Sterki.

*Musculium parvum* STERKI, *Nautilus*, XXIII, 1909, p. 67.

*Habitat*.—Ohio, Indiana, New York, Maine.

*Fossil*.—Michigan.

30. **Musculium australe** sp. nov.

Somewhat like *M. sphaericum*, but smaller; superior margin markedly curved, angular in the middle; beaks prominent, strongly inclined forward; surface shining; shell translucent, corneous.

Since no *M. sphaericum* have been seen from south of northern Ohio and Indiana, and of *M. securis* only a few from South Carolina, small and angular, it appears to be proper to tentatively regard *M. australe* as distinct, differing as it does in size and shape from the species just named.

*Habitat*.—Florida, Alabama, Louisiana. A number of specimens from Tallahassee, Florida, are in the collection of Mr. Bryant Walker and the Carnegie Museum, No. 5,240. These are dead shells, somewhat bleached, but good, and may be regarded as typical. Smaller specimens are at hand from Louisiana, collected by Mr. L. S. Frierson in De Soto Parish and Rambin Bayou in 1903 and 1906 (Carnegie Museum, Nos. 4,257 and 5,230).

31. **Musculium lenticula** (Gould).

*Sphaerium lenticula* (GOULD MS.) Prime, *Proc. Acad. Nat. Sci. Philada.*, 1860, p. 36 [Cited from Dall, *Alaska, Mollusca*, p. 140].

*Sphaerium lenticula* PRIME, *Mon. Corb.*, 1865, p. 51, *excl. syn.*

At least part of the specimens ranged under this name appear to be *M. lacustre* Müller.

*Habitat*.—California, British Columbia (?).

32. **Musculium uintaense** (Call).

*Sphaerium uintaense* R. ELLSWORTH CALL, *Proc. Davenport Acad. Nat. Sci.*, V, 1886, p. 8, figs.

*Habitat*.—Utah; Uinta Mountains at 10,500 ft. above sea-level.

33. **Musculium florissantense** (Cockerell).

*Sphaerium florissantense* T. D. A. COCKERELL, *Bull. Am. Mus. Nat. Hist.*, XXII, Dec., 1906, p. 462, fig. 5.

*Fossil*.—Miocene of Florissant, Colorado.

Genus EUPERA Bourguignat.

*Limosina* Clessin.

1. **Eupera cubensis** (Prime).

*Sphaerium cubense* PRIME, *Mon. Corb.*, p. 58.

*Habitat*.—Florida.

2. **Eupera singleyi** (Pilsbry).

*Sphaerium (Limosina) singleyi* PILSBRY, *Proc. Acad. Nat. Sci. Philada.*, 1889, p. 88, Pl. III, figs. 14, 15.

*Habitat*.—Texas, Louisiana. (Near *E. cubensis*.)

Genus PISIDIUM C. Pfeiffer.

1. **Pisidium virginicum** (Gmelin).

*Tellina virginica* GMELIN, *Syst. Nat.*, VI, 1772, p. 3236.

*Pisidium virginicum* PRIME, *Mon. Corb.*, 1865, p. 61.

*Habitat*.—East of the Rocky Mountains, north to Yukon and Alaska.

*Fossil*.—New York, Michigan, Illinois.

2. **Pisidium amnicum** (Müller).

*Tellina amnica* MÜLLER, *Verm. Hist.*, II, 1774, p. 205.

*Pisidium amnicum* B. B. WOODWARD, *British Pisid.*, 1913, p. 16, figs.

*Pisidium bakeri* PILSBRY, listed by F. C. Baker in *Nautilus*, XIV, p. 71.

*Habitat*.—Lake Ontario, probably introduced from Europe.

3. **Pisidium idahoense** Roper.

*Pisidium idahoense* ROPER, *Nautilus*, IV, 1890, p. 35.

*Habitat*.—Idaho, Washington to Yukon, Lake Michigan, Prince Edward Island.

4. **Pisidium idahoense indianense** Sterki.

*Pisidium idahoense* var. *indianense* STERKI, *Nautilus*, XIX, 1905, p. 80.

*Habitat*.—Lake Maxinkuckee, Indiana.



5. *Pisidium compressum* Prime.

*Pisidium compressum* PRIME, *Boston Proc.*, IV, 1851, p. 161; *Mon. Corb.*, 1865, p. 64.

*Habitat*.—Distributed over the continent, commoner in the East than in the West. The "river and creek form" is regarded as typical.

*Fossil*.—Maine, New Jersey, Ohio, Michigan, Illinois, South Dakota, New Mexico; mostly the var. *lævigatum* and intermediate forms.

6. *Pisidium compressum opacum* Sterki.

*Pisidium compressum* var. *opacum* STERKI, *Nautilus*, XIX, 1905, p. 81.

*Habitat*.—New Jersey, Ohio, Illinois.

7. *Pisidium compressum curvatum* var. nov.

More oblique, less high, less inflated, the posterior and inferior margins forming one continuous curve; striæ rather coarse and sharp to fine and nearly obsolete; color less whitish, more corneous or tan; the "New England form."

*Habitat*.—Maine, Massachusetts.

8. *Pisidium compressum pellucidum* var. nov.

Smaller, less elevated, beaks less pointed, with the ridges slight or vestigial; surface with the striæ slighter, more or less glossy, shell translucent.

*Habitat*.—Ontario, northern New York, Michigan.

9. *Pisidium compressum arrosus* Sterki.

*Pisidium compressum* var. *arrosus* STERKI, *Nautilus*, XIX, 1905, p. 82.

A small, slight, lacustrine and deep-water form.

*Habitat*.—Michigan, Wisconsin.

10. *Pisidium compressum rostratum* Sterki.

*Pisidium compressum* var. *rostratum* STERKI, *Nautilus*, XIX, 1905, p. 82. A lake form.

*Habitat*.—Michigan, Indiana.

11. *Pisidium compressum confertum* Sterki.

*Pisidium compressum* var. *confertum* STERKI, *Nautilus*, XIX, 1905, p. 82.

*Habitat*.—Blue Lake, Muskegon County, Michigan.

12. *Pisidium compressum lævigatum* Sterki.

*Pisidium compressum* var. *lævigatum* STERKI, *Nautilus*, XIX, 1905, p. 81.

Widely distributed; the form of quiet waters. Probably ancestral.

*Fossil*.—Found in many places. See under *P. compressum*.

13. *Pisidium compressum coosaense* Sterki.

*Pisidium compressum* var. *coosaense* STERKI, *Nautilus*, XIX, 1905, p. 83.

Also with rather coarse surface striæ.

*Habitat*.—Georgia, Alabama. Similar forms have been received from Missouri and Oklahoma.

14. *Pisidium compressum contrarium* Sterki.

*Pisidium compressum* var. *contrarium* STERKI, *Nautilus*, XIX, 1905, p. 83.

*Habitat*.—Georgia, Alabama.

15. *Pisidium compressum illinoisense* var. nov.

Mussel about as high as long, some specimens even higher; beaks high, narrow, pointed, with rather small, but well-formed ridges; balance of the mussel more rounded in outline than in typical or near-typical *P. compressum*, less oblique, moderately inflated, markedly flattened in the inferior part, generally even somewhat "pinched," so that the margin is sharp, cutting; surface striæ regular, sharp, medium to fine, and crowded; color light to deep corneous, or brownish; hinge slighter, laminæ thinner, the posterior outer one of the right valve quite small or vestigial.

*Habitat*.—Vicinity of Dubois, Washington County, Illinois, in a reservoir and a pond, and in Sheller Lake, Jefferson County, Illinois. Several thousand specimens were collected by Mr. A. A. Hinkley in 1908 and 1914. All are of the same shape, differing somewhat in size and shade of color, but remarkably uniform in each habitat. It is a peculiar form, having almost the significance of a species.

16. *Pisidium supinum* A. Schmidt.

*Pisidium supinum* SCHMIDT, *Zeitschrift für Malacozoölogie*, VIII, 1850, p. 119.

*Pisidium supinum* CLESSIN, *Monogr. Cycladeen*, in Martini-Chemnitz, 1879, p. 11.

*Pisidium supinum* B. B. WOODWARD, *British Pisidia*, 1913, p. 100, figs.

*Habitat*.—Palearctic and Nearctic regions. Apparently rare in North America; Lake Ontario, Ontario. Two fine specimens have been seen by the writer in a collection labelled "*P. noveboracense* Prime, U. S." (Some other *Sphæriidæ*, apparently from New England, were also marked "U. S.")

17. *Pisidium henslowanum* (Sheppard).

*Tellina henslowana* Leach MS., SHEPPARD, *Trans. Linn. Soc. London*, 1825, p. 150.

*Pisidium henslowanum* B. B. WOODWARD, *British Pisidia*, 1913, p. 93, figs.

*Habitat*.—Palearctic and Nearctic regions. Lake Champlain. "Lake Superior to Lake Winnipeg (Richardson)" cited from Dall, *Alaska, Mollusca*, p. 145.

18. ***Pisidium cruciatum* Sterki.**

*Pisidium cruciatum* STERKI, *Nautilus*, VIII, 1895, p. 97, Pl. II, figs. 1-6, 13.

One of the most remarkable of all *Pisidia*, especially on account of its hinge and the shape of the umbonal ridges, combined with its small size (2 mm. long).

*Habitat*.—Ohio, Michigan, Illinois, Missouri, Arkansas, Alabama.

*Fossil*.—Illinois (lower loess).

19. ***Pisidium kirklandi* Sterki.**

*Pisidium kirklandi* STERKI, *Nautilus*, XIII, 1899, p. 11.

*Habitat*.—Ohio, Michigan, Illinois, Alabama.

20. ***Pisidium fallax* Sterki.**

*Pisidium fallax* STERKI, *Nautilus*, X, 1896, p. 20.

*Habitat*.—New Jersey to South Dakota, Ohio River, Lake Erie.

*Fossil*.—Michigan, New York (Goat Island, Niagara), Ohio, Illinois.

21. ***Pisidium fallax mite* Sterki.**

*Pisidium fallax* var. *mite* STERKI, *Nautilus*, XIX, 1905, p. 84.

*Habitat*.—Ohio, Michigan.

22. ***Pisidium fallax septentrionale* Sterki.**

*Pisidium fallax* var. *septentrionale* STERKI, *Nautilus*, XII, 1898, p. 78.

*Pisidium fallax* var. *errans* STERKI, *Nautilus*, XIX, 1905, p. 84.

(It is the opinion of Dr. Bryant Walker that the arrangement should be as here given, Prime's *P. septentrionale* not having been described.)

Markedly different from *P. fallax*.

*Habitat*.—Northern Maine, Michigan, Minnesota, Iowa, Keewatin.

23. ***Pisidium hinkleyi* sp. nov.**

Mussel small, subtriangular, very inequipartite, oblique, moderately inflated; superior margin strongly curved, posterior rounded, forming one continuous curve with the inferior from the beaks to the rounded-angular anterior end situated well below the longitudinal median line; supero-anterior slope well remote from the beaks, slightly marked and somewhat curved, short, steep; beaks near the posterior

end, with a small flattened area on top, each with a slight to somewhat lamellar ridge in the middle of the nepionic shell;<sup>2</sup> surface dullish, microscopically rugulose, with rather fine, sharp, regular to subregular concentric striae; color pale corneous; shell rather strong, subtranslucent; hinge well curved, very stout, plate broad; cardinal teeth small, the right angular with the posterior part thick and deeply grooved; below it is a deep excavation for the left anterior, with the edge of the plate raised over its general level; left anterior placed somewhat obliquely and well above the edge of the plate, strongly curved upward, pointed; the posterior short, oblique, slightly curved; laminae stout, strongly rugulose, their cusps barely or slightly pointed, moderately abrupt; ligament and resilium short, stout.

*Measurements*.—Long. 2.6; alt. 2.4; diam. 1.6 mm. (100 : 92 : 69).

*Habitat*.—Chains, Wabash River, Posey County, Indiana, collected by Mr. A. A. Hinkley in 1908, and it is with pleasure that I name the species after him. Type specimens are in the collection of Mr. Hinkley and in the Carnegie Museum, No. 7,857. Although only a few specimens are at hand, from young to full-grown, they are sufficient to show that the species is well characterized and distinct, belonging to the same group (*Rivulina*) with *P. compressum*, *punctatum*, etc. From the former they differ by the much smaller size, the shape, and having the hinge well curved, but not angular. From *punctatum* they differ as follows: they are larger, more oblique, the beaks being more posterior and more prominent; the superior margin is more curved, the hinge is much stouter. The specimens were in company with a few *P. punctatum simplex* (full-grown, long. 1.5; alt. 1.4; diam. 1.2 mm.).

<sup>2</sup> It appears to be in place at this point to state that the ridges on the beaks of all *Pisidia* of this group: *P. compressum*, *supinum*, *fallax*, *cruciatum*, *punctatum*, *henslowanum*, etc., are not at the inferior margins of the nepionic valves, but at about their middle; they are parallel with the lines of growth, and in most instances highest in their posterior parts, and thus the beaks of the mature mussels appear more pointed. In *P. henslowanum* the ridges are near the posterior margin, and thus oblique, appearing almost radial. The ridges are formed by a curving-out, or bulging, of the shell, concave inside in the very young mussels, and consequently are not "appendages," as they once were generally termed. There was a time when the ridges on the beaks were regarded as the distinguishing and characteristic feature of *P. compressum* Prime; but on the one hand there are a number of manifestly distinct species (outside of *supinum* and *henslowanum*) having ridged beaks, and on the other hand there are some forms of *P. compressum* without any ridges.

**24. *Pisidium punctatum* Sterki.**

*Pisidium punctatum* STERKI, *Nautilus*, VIII, 1895, p. 99, Pl. II, figs. 7-12, 14.

*Habitat*.—Maine to Virginia and Minnesota.

*Fossil*.—Illinois (loess).

**25. *Pisidium punctatum armatum* Sterki.**

*Pisidium punctatum* var. *armatum* STERKI, *Nautilus*, XIX, 1905, p. 84.

*Habitat*.—Ohio.

**26. *Pisidium punctatum simplex* Sterki.**

*Pisidium punctatum* var. *simplex* STERKI, *Nautilus*, XIX, 1905, p. 84.

*Habitat*.—New England to Ohio, Indiana, Illinois, Wisconsin, Michigan, Missouri; Cf. No. 23.

**27. *Pisidium limatulum* Sterki.**

*Pisidium limatulum* STERKI, *Nautilus*, XVIII, 1905, p. 108.

*Habitat*.—Alabama to Texas; northeastern Ohio.

**28. *Pisidium handwerki* Sterki.**

*Pisidium handwerki* STERKI, *Nautilus*, XIII, 1899, p. 90.

*Habitat*.—Illinois, Michigan.

**29. *Pisidium æquilaterale* Prime.**

*Pisidium æquilaterale* PRIME, *Boston Journ.*, VI, 1852, p. 366, Pl. XII, figs. 23-25;  
*Mon. Corb.*, 1865, p. 63.

*Habitat*.—Maine to New York and Virginia, Ontario (Ottawa River); reported from Michigan and northward and westward, but I have seen no specimens from those regions.

*Fossil*.—New Jersey.

**30. *Pisidium fraudulentum* Sterki.**

*Pisidium fraudulentum* STERKI, *Nautilus*, XXVI, 1912, p. 95.

Somewhat variable.

*Habitat*.—Eastern Virginia, Kentucky, Illinois, Iowa, Missouri, Mississippi.

**31. *Pisidium fraudulentum peraltum* Sterki.**

*Pisidium peraltum* STERKI, *Nautilus*, XIV, 1900, p. 5 (*partim*).

Smaller than *P. fraudulentum*, less oblique; the beaks are fuller and



more rounded, and the appearance of the surface is somewhat different. It appears that the two *Pisidia* (Nos. 30 and 31) are conspecific, although intermediate and connecting forms have not been seen. If this view be correct, *P. fraudulentum* should be regarded as typical, being widely distributed, even though such procedure would be contrary to the formal rule of priority.

*Habitat*.—Michigan.

*Fossil*.—Michigan, Ohio (?).

32. *Pisidium latchfordi* sp. nov.

Mussel small, inequipartite, oblique, nearly oval in lateral aspect, well inflated; beaks somewhat posterior, rather large, prominent, rounded; superior margin curved, supero-anterior slope slightly marked, short, anterior end rounded, well below the longitudinal axis; posterior part short, subtruncate, or rounded; surface slightly glossy, with very fine and slight microscopic striæ, colorless to whitish, shell translucent to opaque; hinge rather long, curved-angular, stout, plate rather broad, short; right cradinal tooth well curved, not much projecting, its posterior end not or but little thicker; between it and the somewhat projecting lower edge of the plate there is an elongate-triangular excavation for the left anterior, well-defined all around; left anterior set rather well up on the plate, small, posterior oblique, curved; laminae rather massive, with their surfaces rugose, the anterior and posterior at right angles to each other; cusps of the left ones pointed, with the proximal and distal slopes steep and almost equal, those of the right inner less pointed, outer anterior about one-third the length of the inner, posterior short and small; ligament short, resilium stout.

*Measurements*.—Long. 2.6; alt. 2.4; diam. 1.9 mm. (100 : 93 : 73).

*Habitat*.—Ontario, apparently rare. Collected in 1913 by High Justice F. R. Latchford, in whose honor the species is named. It occurs in Scott Graham Creek, Graham Bay Creek, and Hare's Spring, all in Carleton County, Ontario. Specimens are in the collection of Justice Latchford and in the Carnegie Museum, Nos. 7,439 and 7,475. Only a rather small number of specimens are at hand, but markedly uniform, and different from all other described species. Their shape, the formation of the hinge, and the stout, short ligament and resilium place them in a group with *P. æquilaterale*, *fraudulentum*, etc.

33. *Pisidium variabile* Prime.

*Pisidium variabile* PRIME, *Boston Proc.*, IV, 1851, p. 163; *Mon. Corb.*, 1865, p. 66.

*Pisidium mirabile* (WHITEMORE) CLESSIN, *Monogr. Cycladeen* in Martini-Chemnitz, 1879, p. 49, Pl. 6, figs. 1-3, 19-21.

Rather variable.

*Habitat*.—Widely distributed over the continent, except, apparently, in the South; common in the Northeast, ranging from New England and New York to Michigan.

*Fossil*.—Maine, New Jersey, Ohio, Michigan, Ontario, Illinois, South Dakota.

34. *Pisidium variabile cicer* Prime.

*Pisidium cicer* PRIME, *Ann. N. Y. Lyc.*, VI, 1853, p. 65, Pl. I, fig. 1. Synonym of *P. compressum* PRIME, *Mon. Corb.*, 1865, p. 65.

A form of *variabile*, not of *compressum*, as is proved by the specimens in the collection of T. Prime, preserved in the Museum of Comparative Zoölogy, and in other collections.

*Habitat*.—Massachusetts, Maine:

35. *Pisidium variabile brevius* Sterki.

*Pisidium variabile* var. *brevius* STERKI, *Nautilus*, XIX, 1906, p. 118.

*Habitat*.—Ohio and Michigan to South Dakota, Keewatin.

*Fossil*.—Michigan, Ontario.

36. *Pisidium variabile magnum* var. nov.

Considerably larger than any eastern form, strongly inflated, shell and hinge slighter.

*Habitat*.—Washington, Montana.

37. *Pisidium variabile hybridum* Sterki.

*Pisidium variabile* var. *hybridum* STERKI, *Nautilus*, XIX, 1906, p. 118.

Apparently a perpetuated hybrid, *P. variabile* × *aequilaterale*.

*Habitat*.—Herkimer County, New York.

38. *Pisidium minusculum* Sterki.

*Pisidium minusculum* STERKI, *Nautilus*, XX, 1906, p. 17.

*Habitat*.—Wisconsin, Ohio.

<sup>3</sup> A number of specimens labelled "*P. mirabile* Whittemore, Mass.," evidently authentic, are contained in the Anthony Collection in the Museum of Comparative Zoölogy. They are not distinct from *P. variabile*, and Clessin's description and figure also differ very little.

39. ***Pisidium glabellum* Sterki.**

*Pisidium glabellum* STERKI, *Nautilus*, XXVI, 1913, p. 137.

Variable. Some of the forms ranged under this species may be distinct. In spite of its minute size, it seems to fall into the same group with *P. variabile*.

*Habitat*.—New England, New Jersey, Pennsylvania to Ontario, Minnesota, and Manitoba.

40. ***Pisidium sphæricum* Sterki.**

*Pisidium sphæricum* STERKI, *Nautilus*, XXVI, 1912, p. 8.

This very distinct species has been badly misunderstood, and is found in collections under the names *P. abditum* Haldeman, *adamsi* (Roper), *minus* (Sterki).

*Habitat*.—Maine to Virginia, Ontario.

*Fossil*.—Maine.

41. ***Pisidium adamsi* Prime.**

*Pisidium adamsi* STIMPSON, *Moll. of New England*, 1851, p. 16.

*Pisidium adamsi* PRIME, *Mon. Corb.*, 1865, p. 63.

*Habitat*.—Norway, Maine; Holly, Michigan.

42. ***Pisidium adamsi affine* Sterki.**

*Pisidium affine* STERKI, *Nautilus*, XV, 1901, p. 66.

When *P. affine* was published, I had seen no *P. adamsi*, and from the description of the latter it was not evident that the two were of the same species. *P. affine* is the common, widely distributed, most characteristic form; *P. adamsi* a somewhat extreme local form, as shown by the specimen in the Prime Collection.

*Habitat*.—Maine to Virginia and Minnesota.

*Fossil*.—Ohio, Michigan, Illinois.

43. ***Pisidium sargenti* Sterki.**

*Pisidium sargenti* STERKI, *Nautilus*, XV, 1901, p. 67.

Moderately variable.

*Habitat*.—New England and Pennsylvania to Iowa, Missouri, and Arkansas.

*Fossil*.—Michigan, Illinois (loess).

44. ***Pisidium noveboracense* Prime.**

*Pisidium noveboracense* PRIME, *Ann. N. Y. Lyc.*, VI, 1853, p. 66, Pl. I, fig. 3; *Mon. Corb.*, 1865, p. 67.

Very variable.

*Habitat*.—East of the Mississippi River; New England and New York to Illinois (the more typical form), especially in spring brooks.

*Fossil*.—New Jersey, Michigan.

45. ***Pisidium noveboracense expansum* Sterki.**

*Pisidium noveboracense* var. *expansum* STERKI, *Nautilus*, XIX, 1906, p. 118.

*Habitat*.—Michigan.

46. ***Pisidium noveboracense quadrulum* Sterki.**

*Pisidium noveboracense* var. *quadrulum* STERKI, *Nautilus*, XIX, 1906, p. 119.

*Habitat*.—Ohio, spring marshes.

47. ***Pisidium noveboracense lineatum* Sterki.**

*Pisidium noveboracense* var. *lineatum* STERKI, *l. c.*, p. 119.

*Habitat*.—Michigan lakes.

48. ***Pisidium noveboracense fraternum* Sterki.**

*Pisidium noveboracense* var. *fraternum* STERKI, *l. c.*, p. 120.

*Habitat*.—Ohio, Illinois.

49. ***Pisidium noveboracense alabamense* Sterki.**

*Pisidium noveboracense* var. *alabamense* STERKI, *l. c.*, p. 120.

*Habitat*.—Alabama, Mississippi.

50. ***Pisidium elevatum* Sterki.**

*Pisidium noveboracense* var. *elevatum* STERKI, *l. c.*, p. 119.

Appears to be a distinct species.

*Habitat*.—Ohio, Illinois, Ontario.

51. ***Pisidium regulare* Prime.**

*Pisidium regulare* PRIME, *Boston Journ.*, VI, 1852, p. 363, Pl. XII, figs. 11, 12;

*Mon. Corb.*, 1865, p. 68, as synonym of *P. abditum*.

*Habitat*.—Michigan, Ontario.

*Fossil*.—Michigan.

52. ***Pisidium regulare* (?) *danielsi* Sterki.**

*Pisidium danielsi* STERKI, *Nautilus*, XVII, 1903, p. 42.

Somewhat larger, beaks broader, surface striæ coarser, color more yellowish.

*Habitat*.—Michigan, Indiana.

53. **Pisidium friersoni** Sterki.

*Pisidium friersoni* STERKI, *Nautilus*, XX, 1906, p. 20.

*Habitat*.—Louisiana, Texas, Arkansas, Colorado.

54. **Pisidium atlanticum** Sterki.

*Pisidium atlanticum* STERKI, *Nautilus*, XVIII, 1905, p. 128.

*Habitat*.—Georgia, Florida to Texas, Arkansas.

55. **Pisidium atlanticum dispar** Sterki.

*Pisidium dispar* STERKI, *Nautilus*, XXV, 1911, p. 2.

Less oblique, beaks narrower.

*Habitat*.—Alabama.

56. **Pisidium atlanticum albidum** Sterki.

*Pisidium albidum* STERKI, *l. c.*, p. 2.

Less oblique; surface dull, with coarser, sharper striae.

*Habitat*.—Alabama.

57. **Pisidium trapezoideum** Sterki.

*Pisidium trapezoideum* STERKI, *Nautilus*, IX, 1896, p. 124.

*Habitat*.—Eastern Pennsylvania to Virginia, apparently near the coast.

58. **Pisidium trapezoideum protensum** var. nov.

Mussel more oblique, larger, anterior part much longer. Specimens are contained in the collection of Mr. W. G. Mazyck, No. 662, and in the Carnegie Museum, No. 7387.

*Habitat*.—Columbia, Pennsylvania.

59. **Pisidium neglectum** Sterki.

*Pisidium neglectum* STERKI, *Nautilus*, XX, 1906, p. 87.

Near the palearctic *P. pusillum* (Gmelin) Jenyns, and possibly conspecific.

*Habitat*.—East of the Rocky Mountains, apparently rare in the South.

*Fossil*.—Ohio. (Probably overlooked elsewhere.)

60. **Pisidium neglectum corpulentum** var. nov.

More inflated; beaks larger and more prominent; upper margin more curved. While markedly different from *P. neglectum*, and apparently distinct, there seem to be intermediate forms; but the specimens from a given locality are generally of one form only.



*Habitat*.—Ohio (Carn. Mus., No. 3407); Illinois (Carn. Mus., No. 984); Michigan (Carn. Mus., No. 2655).

61. **Pisidium succineum** Sterki.

*Pisidium succineum* STERKI, *Nautilus*, XX, 1907, p. 99.

*Habitat*.—Massachusetts, New York, Pennsylvania to Virginia, Ontario, Ohio, Indiana, Michigan.

62. **Pisidium scutellatum** Sterki.

*Pisidium scutellatum* STERKI, *Nautilus*, X, 1896, p. 66.

Very variable, and there are several well-marked varieties.

*Habitat*.—Lake Champlain, Vermont; region of Great Lakes and as far west as Montana; Yukon Territory.

63. **Pisidium walkeri** Sterki.

*Pisidium walkeri* STERKI, *Nautilus*, IX, 1895, p. 75.

*Habitat*.—Maine to Virginia and Ontario, Missouri, South Dakota.

*Fossil*.—Illinois (marl and loess).

64. **Pisidium overi** Sterki.

*Pisidium overi* STERKI, *Nautilus*, XXVI, 1913, p. 136.

*Habitat*.—South Dakota, Iowa, Minnesota.

65. **Pisidium mainense** Sterki.

*Pisidium walkeri* var. *mainense* STERKI, *Nautilus*, XII, 1898, p. 79.

This is a distinct species.

*Habitat*.—Maine, Massachusetts, Ontario, Ohio, Michigan, Illinois.

*Fossil*.—Maine, Ontario, Ohio, Michigan, Illinois.

66. **Pisidium cuneiforme** Sterki.

*Pisidium cuneiforme* STERKI, *Nautilus*, XVII, 1903, p. 81.

May range near *P. compressum*.

*Habitat*.—Lake Michigan, obtained by dredging.

67. **Pisidium superius** Sterki.

*Pisidium superius* STERKI, *Nautilus*, XX, 1907, p. 98.

*Habitat*.—Northern Michigan, Lake Nipissing, Ontario.

68. **Pisidium steenbuchi** (Möller).

*Cyclas steenbuchi* MÖLLER, *Index Moll. Grænlantiæ*, 1842, p. 20.

*Pisidium steenbuchi* B. B. WOODWARD, *British Pisidia*, 1913, p. 107, figs.

*Habitat*.—Palearctic and Nearctic Regions; Greenland; Labrador, Ungava.

69. **Pisidium minus** (Adams).

*Cyclas minor* C. B. ADAMS, *Boston Proc.*, I, 1841, p. 48; PRIME, *Mon. Corb.*, 1865, p. 68, as synonym of *P. abditum*. Cf. STERKI, *Nautilus*, XXVI, 1912, p. 7.

*Habitat*.—Maine, Massachusetts, Ontario, New York, District of Columbia.

70. **Pisidium allenii** Sterki.

*Pisidium allenii* STERKI, *Nautilus*, XXVI, 1912, p. 9.

*Habitat*.—Maine, New Hampshire, New York; Wisconsin (?).

71. **Pisidium roperi** Sterki.

*Pisidium roperi* STERKI, *Nautilus*, XII, 1898, p. 77.

*Habitat*.—New England to Illinois, Minnesota, Ontario, Manitoba, Alberta, Montana.

*Fossil*.—Michigan.

72. **Pisidium complanatum** Sterki.

*Pisidium complanatum* STERKI, *Nautilus*, XVII, 1903, p. 79.

*Pisidium fragillimum* STERKI, *Nautilus*, XX, 1906, p. 18.

*Habitat*.—Michigan, Wisconsin, Iowa.

73. **Pisidium strengii** Sterki.

*Pisidium strengii* STERKI, *Nautilus*, XV, 1902, p. 126.

*Habitat*.—Region of Great Lakes; Ohio (also in the drainage of the Ohio River); Maine, Maryland.

*Fossil*.—Michigan.

74. **Pisidium politum** Sterki.

*Pisidium politum* STERKI, *Nautilus*, IX, 1895, p. 75.

*Habitat*.—New York, Pennsylvania, Ohio, Ontario to Illinois and Minnesota.

*Fossil*.—Michigan.

75. **Pisidium politum decorum** var. nov.

Mussel smaller, slighter; shell more translucent to transparent, pale corneous to nearly colorless. May be distinct.

*Habitat*.—Ohio, Indiana, Michigan, Illinois.

76. **Pisidium streatori** Sterki.

*Pisidium streatori* STERKI, *Nautilus*, XIV, 1901, p. 100.

Variable; some regional forms are markedly different from each other.

*Habitat*.—New York, Ohio, Indiana, Michigan, Ontario, Maine.

77. *Pisidium abditum* Haldeman.

*Pisidium abditum* HALDEMAN, *Proc. Acad. Nat. Sci. Philada.*, I, 1841, p. 53.

*Pisidium abditum* PRIME, *Mon. Corb.*, 1865, p. 6 (excluding some synonyms):

Cf. STERKI, *Nautilus*, XXVI, 1912, p. 6.

Variable. A great many *Pisidia* have been named *abditum*, and such misidentified and often mixed lots are the bane of collections, as is also the case with *Sphærium striatinum*.

It seems that *P. abditum* is not specifically distinct from the European *fontinale* Pfeiffer (not including *casertanum* Poli) also very variable; at any rate they are plainly of common origin. Yet to substitute the older name at the present time would only add to the already endless confusion.

*Habitat*.—East of the Rocky Mountains; common in the Northeast; apparently scarce west of Ohio; not seen from the Southwest and the Gulf States.

78. *Pisidium abditum* (?) *lacteum* var. nov.

Mussel about 3.5 mm. long, somewhat elongate, higher in front of the beaks than behind, and thus the beaks are apparently somewhat inclined backward; anterior end more angular (rounded) than in *P. abditum*; shell colorless, glassy-transparent to whitish, translucent to opaque, usually with alternating zones of these shades.

*Habitat*.—Massachusetts. Found at various places in the vicinity of Danvers by the Rev. Mr. H. W. Winkley, and also collected by the writer in brooks in the vicinity of South Framingham. The form is represented in the Carnegie Museum by No. 7224 from Danvers.

At this point it may be proper to call attention to the fact that *P. roseum* Scholtz (*nec* Jenyns) has been regarded as a distinct species by some European authors, by others as a variety or subspecies of *P. fontinale* Pfeiffer. A North American *Pisidium* from New England and eastern New York seems to be identical, and apparently connected with *P. abditum* by intermediate forms.

79. *Pisidium subrotundum* Sterki.

*Pisidium subrotundum* STERKI, *Nautilus*, XX, 1906, p. 19.

Near *P. abditum*, but is probably distinct. In over a hundred lots in the collection every specimen is plainly *P. subrotundum*. Moreover the two forms have repeatedly been found associated, and always easily separable. *P. subrotundum* is generally more northern and appears to be more ancient.

*Habitat*.—New England and New York to Ohio, Indiana, Ontario, Michigan, Minnesota. Specimens from Montana (Pacific drainage) and Oregon appear to be identical.

*Fossil*.—Maine, Michigan.

80. ***Pisidium subrotundum canadense*** var. nov.

Mussel larger. Long. 5.5; alt. 4.6; diam. 3.4 mm. More oblique; beaks more posterior; upper margin markedly straight, slightly alate in front of the beaks and bounded by an angle. In shape they somewhat resemble *P. ovum* from Montana, but are less inflated and the hinges are different. Some specimens in the same lot have the beaks narrower and are more markedly different from *P. subrotundum*.

*Habitat*.—Hare's Spring, Carleton County, Ontario, collected in considerable numbers by Justice F. R. Latchford. Represented in his collection, and in the Carnegie Museum, No. 7437. May be distinct.

81. ***Pisidium subrotundum olofi*** var. nov.

Smaller, 2.5–3 mm. long. Shell translucent to transparent. Appears to be a regional variety.

*Habitat*.—Maine; Aroostook County, at various places, collected in 1898 by Mr. Olof O. Nylander, *e. g.*, Carnegie Museum, Nos. 2313 and 2378; Thomaston, collected by Mr. N. W. Lermond, 1910.

82. ***Pisidium subrotundum pumilum*** var. nov.

Rather small, variable in size, 2–3.5 mm. long. Rather high, moderately inflated; superior margin nearly straight, bounded by angles; the remainder of the outline short-elliptical to almost circular; beaks not much behind the middle; surface with rather coarse, irregular striæ; color pale corneous, shell less translucent.

*Habitat*.—Danvers, Massachusetts. Rev. Mr. H. W. Winkley collected hundreds of specimens from a water-hole in a cemetery at Danvers in 1909. Similar forms have been received from several other places; Carnegie Museum No. 6133; Pennsylvania, C. M., No. 5729; Michigan.

83. ***Pisidium inornatum*** Sterki.

*Pisidium inornatum* STERKI, *Nautilus*, XXV, 1911, p. 3.

*Habitat*.—Alabama.

84. **Pisidium vexum** sp. nov.

Mussel small, slightly inequipartite and oblique, rather well inflated; beaks slightly posterior, rather broad, more or less flattened on top; moderately prominent, descending abruptly toward the posterior part; superior margin nearly straight, bounded by angles, posterior margin subtruncate or rounded, passing into the moderately curved inferior without an angle, anterior end rather broadly rounded, supero-anterior slope marked, nearly straight; surface dullish to somewhat shining, with very fine and slight subregular striæ. Shell thin, translucent to transparent, colorless; hinge rather slight, but well-formed, moderately long, plate rather narrow; cardinal teeth rather long, the right curved to nearly straight in its middle, its posterior end thicker and grooved to bifid, left anterior more curved (in plane), not much bent upward, posterior long, nearly straight and little oblique; laminae: right anterior inner rather long, its cusp nearer the cardinal; outer short; posterior both short; left: both with the cusps rather abrupt, pointed; ligament short, resilium rather stout.

*Measurements*.—(Specimen from Ontario) Long. 2.5; alt. 2.1; diam. 1.5 mm. (100 : 84 : 60). (Specimen from Massachusetts) Long. 3; alt. 2.5; diam. 2.1 mm. (100 : 83 : 70).

*P. vexum* is somewhat like *P. inornatum* in size and shape, but more inflated; the shell and hinge are slighter, and the depressed beaks distinguish it.

*Habitat*.—Lake Gorman, Renfrew County, Ontario, collected by Justice F. R. Latchford, August 29, 1913. Types are in Justice Latchford's Collection and in the Carnegie Museum, No. 7455. One specimen, somewhat larger, was collected in Hounds Ditch, Duxbury, Massachusetts, by Mr. William F. Clapp in 1913.

85. **Pisidium ohioëense** Sterki.

*Pisidium ohioëense* STERKI, *Nautilus*, XVII, 1903, p. 20.

*Habitat*.—Maine, Massachusetts, Ohio, Michigan, Ontario.

86. **Pisidium splendidulum** Sterki.

*Pisidium splendidulum* STERKI, *Nautilus*, XI, 1898, p. 113.

One of the commonest species and very variable; a few of the main forms are named.

*Habitat*.—Maine to Virginia and Minnesota.

*Fossil*.—Maine, Ohio, Michigan, Illinois.



87. *Pisidium splendidulum corneolum* var. nov.

More oblique, well inflated, beaks more elevated and narrower; often lighter in color to nearly colorless.

*Habitat*.—Ohio, Indiana, Michigan.

88. *Pisidium splendidulum novangliæ* var. nov.

Much smaller, about 2 mm. long, well inflated, beaks rather narrow.

*Habitat*.—Maine, Massachusetts. Common, often associated with larger forms.

89. *Pisidium splendidulum miliastrum* var. nov.

Small, superior and inferior margins little curved to nearly straight; well inflated; resembling small forms of *P. milium*.

*Habitat*.—Maine, Massachusetts.

90. *Pisidium lermondi* Sterki.

*Pisidium lermondi* STERKI, *Nautilus*, XXVI, 1913, p. 138.

In shape markedly different from all other *Pisidia*, yet it may be near *P. splendidulum*.

91. *Pisidium milium* Held.

*Pisidium milium* HELD, *Isis*, 1836, p. 280; CLESSIN, *Monogr. Cycladeen* in Martini-Chemnitz, 1879, p. 20, Pl. 2, figs. 4-7; Pl. 5, figs. 16-17 (the figures show the outlines too angular); B. B. WOODWARD, *British Pisidia*, 1913, p. 70, figs.

*Habitat*.—Palearctic and Nearctic Regions; Maine, New York, Ontario, Michigan, Minnesota, Manitoba.

92. *Pisidium contortum* Prime.

*Pisidium contortum* PRIME, *Ann. N. Y. Lyc.*, VI, 1853, p. 65, Pl. I, fig. 2; *Mon. Corb.*, 1865, p. 73.

Described as fossil, but lately found also as recent.

*Habitat*.—Maine, Ontario, Michigan.

*Fossil*.—Massachusetts (Originals), Maine, Ontario, Michigan.

93. *Pisidium contortum* (?) *triangulare* var. nov.

Smaller, shorter, especially the anterior part; beaks narrower.

*Fossil*.—Maine, Michigan.

94. *Pisidium imbecille* Sterki.

*Pisidium imbecille* STERKI, *Nautilus*, XIV, 1900, p. 5.

*Habitat*.—Maine, Michigan, Montana (Pacific drainage).

95. **Pisidium monas** Sterki.

*Pisidium monas* STERKI, *Nautilus*, XIV, 1900, p. 5.

Possibly a variety of *P. imbecille*, but intermediate forms have not been seen.

*Habitat*.—Northern Michigan, Maine.

96. **Pisidium abyssorum** (Stimpson) Sterki.<sup>4</sup>

*Pisidium abyssorum* (Stimpson) STERKI, *Nautilus*, XI, 1898, p. 124.

*Habitat*.—Dredged from deep water in Lake Michigan and also taken from the stomachs of whitefish.

*P. levissimum* Sterki, *Nautilus*, XX, 1906, p. 18, somewhat resembles *P. abyssorum* in size and shape, but may be distinct. It occurs in Wisconsin.

97. **Pisidium tenuissimum** Sterki.

*Pisidium tenuissimum* STERKI, *Nautilus*, XIV, 1901, p. 99.

Quite common and rather variable. In the past it evidently was very common, and there are some fossil forms differing considerably from recent ones.

*Habitat*.—Region of the Great Lakes; Ohio (occurring in the Ohio River drainage area).

*Fossil*.—Maine, Ohio, Michigan, Illinois.

98. **Pisidium pauperculum** Sterki.

*Pisidium pauperculum* STERKI, *Nautilus*, X, 1896, p. 64.

Very variable.

*Habitat*.—New England and New York to Ohio, Ontario, and Minnesota.

*Fossil*.—Maine, New Jersey, Ohio, Michigan, Ontario (partly including varieties).

99. **Pisidium pauperculum nylanderi** Sterki.

*Pisidium pauperculum nylanderi* STERKI, *Nautilus*, XI, 1898, p. 125.

*Habitat*.—Maine, Ontario, Michigan.

*Fossil*.—Maine.

100. **Pisidium pauperculum crystalense** var. nov.

Mussel higher, beaks more prominent; shell transparent to translucent, almost colorless to amber-colored. (The name is derived from Crystal Lake, Michigan.)

<sup>4</sup> With respect to the name see Sterki, *l. c.*

*Habitat*.—Ontario and Ohio to South Dakota.

*Fossil*.—Ohio.

101. *Pisidium pauperculum sulphureum* var. nov.

Less high, oblique, somewhat rhombic in outline, little to moderately inflated; beaks little elevated; superior margin less curved than in other forms of *P. pauperculum*, inferior little curved to nearly straight; surface polished; color light to sulphur-yellow in fresh, brownish in dead shells; hinge slighter, and somewhat different, especially the left anterior cardinal tooth, which is shorter and more abrupt anteriorly. Markedly different from the other forms of *P. pauperculum*, and possibly a distinct species.

*Habitat*.—Mountain Lake and Ives Lake, Marquette County, Michigan, and "Marquette County," collected by Mr. Bryant Walker in 1898, 1906, and 1900; Brooks Lake, Newaygo County, Michigan, collected by Mr. L. H. Streng in 1899; Lake Nipissing, Ontario, collected by Justice F. R. Latchford in 1913 (Carn. Mus., No. 7463).

102. *Pisidium ovum* sp. nov.

Mussel of medium size, inequipartite, somewhat oblique, strongly and evenly inflated, nearly globular; beaks markedly posterior, large and broad, rounded, not mamillar, moderately prominent; superior margin short, nearly straight, bounded by angles which are only slightly marked in some adult, but well-marked in young and adolescent mussels, as to the rest of the outline oviform, with the anterior end rather broadly rounded; surface more or less glossy, with fine to very fine, irregular concentric striae and several lines of growth at irregular intervals; color straw to deep corneous; shell thin, translucent; hinge slight, short, plate very narrow; cardinal teeth small, the right moderately curved, its posterior part thicker, both left teeth quite short and markedly abrupt, the posterior oblique and slightly curved; laminae rather short and slight, outer ones in the right valve quite small; cusps placed rather proximally, with very steep slopes, spine-like, pointed; ligament moderately long, resilium slight.

MEASUREMENTS.

Long. 4.8; alt. 4.2; diam. 3.5 mm. (100 : 88 : 73).

Long. 4. ; alt. 3.3; diam. 2.7 mm. (100 : 82 : 67).

Long. 3.5; alt. 3. ; diam. 2.4 mm. (100 : 86 : 67).

*P. ovum* is so characteristic that it may be recognized at once, and cannot be mistaken for any other species. Forms of *P. subrotundum* of somewhat the same size and appearance are less inflated, less oblique, having the superior margin longer and less marked-off, and the hinge longer and differently formed. Its shape, and especially its hinge, place *P. ovum* in a group with *P. rotundatum*, *ventricosum*, etc., as the largest of them.

*Habitat*.—Montana, Colorado.

It was collected by Mr. L. E. Daniels in 1912 and 1915 in the Bitter Root Valley (Pacific drainage), Montana, at several localities. In 1906 it was taken by Judge Junius Henderson in Boulder Creek, Boulder County, Colorado, at an elevation of 9,000 ft. Specimens collected by Judge Henderson were received by the writer from Mr. Bryant Walker in 1910 and shelved as "(?)." From various localities in the Bitter Root Valley there come variant forms, fairly constant from each place, some larger and lighter in color, others smaller and darker. Two lots combined are regarded as types: specimens in the collection of Mr. Daniels, and Carnegie Museum No. 7144, from the eastern side of the Bitter Root River at Ward, and Carnegie Museum No. 7132, from the Bitter Root River-bottom at Charlos.

A somewhat unique feature found in a half-grown specimen belonging to Carnegie Museum No. 7144 appears to be worthy of notice. The right valve has two cardinal teeth. The posterior part of the regular cardinal is not thicker than the rest; above it is a small, short, lamellar tooth, and between the two is the groove corresponding with the posterior cardinal of the left valve. In the latter there is a distinct excavation bounded below by the posterior cardinal and above by the nymph and the rim of the resilium for the reception of the additional right cardinal.

### 103. *Pisidium rotundatum* Prime.

*Pisidium rotundatum* PRIME, *Boston Proc.*, IV, 1851, p. 164; *Mon. Corb.*, 1865, p. 72.

Two poor valves apparently belonging to this species, as understood, are contained in the T. Prime Collection.

*Habitat*.—New England and New York to Ontario, Ohio, Minnesota, Manitoba, Montana (Pacific drainage). It seems to occur also in Europe.

*Fossil*.—Michigan.

104. **Pisidium ventricosum** Prime.

*Pisidium ventricosum* PRIME, *Boston Proc.*, 1851, p. 87; *Mon. Corb.*, 1865, p. 72.

*Habitat*.—New England (common); New York, Michigan (rare).

*Fossil*.—Maine, Michigan.

105. **Pisidium vesiculare** Sterki.

*Pisidium vesiculare* STERKI, *Nautilus*, X, 1896, p. 21.

*Habitat*.—Region of the Great Lakes.

*Fossil*.—Michigan.

106. **Pisidium vesiculare striatellum** var. nov.

Beaks broader, surface with a silky gloss from the sharper striæ, shell more translucent, nearly colorless.

*Habitat*.—Collected by Mr. L. E. Daniels, 1903, in Lake Maxinkuckee, Indiana, in waters from fourteen to eighteen feet deep (Carn. Mus. No. 4702).

107. **Pisidium medianum** Sterki.

*Pisidium medianum* STERKI, *Nautilus*, XIII, 1899, p. 10.

*Habitat*.—Region of the Great Lakes, common, especially in Michigan, which seems to be the center of distribution, Mohawk, N. Y., Ohio, also in Ohio River drainage.

*Fossil*.—Ontario, Michigan, Ohio, Illinois.

108. **Pisidium medianum clarum** var. nov.

Large for the species, somewhat elongate, shell translucent to transparent, amber-colored.

*Habitat*.—Clear Lake, Steuben County, Indiana, collected by Mr. L. E. Daniels, July 7, 1904 (Carnegie Museum, No. 4878); similar, but somewhat smaller specimens were collected by Mr. Bryant Walker in Hillsdale County, Michigan, in 1900.

109. **Pisidium medianum minutum** Sterki.

*Pisidium medianum* var. *minutum* STERKI, *Nautilus*, XIII, 1899, p. 11.

*Habitat*.—Maine, Massachusetts, New York.

*Fossil*.—Maine.

110. **Pisidium costatum** Sterki.

*Pisidium costatum* STERKI, *Nautilus*, XVII, 1903, p. 22.

*Fossil*.—Maine, Michigan. (Probably also recent.)



111. **Pisidium ferrugineum** Prime.

*Pisidium ferrugineum* PRIME, *Boston Proc.*, IV, 1851, p. 162.

*Habitat*.—New England and eastern New York, common.

112. **Pisidium rowelli** Sterki.

*Pisidium rowelli* STERKI, *Nautilus*, XVII, 1903, p. 80.

*Habitat*.—California.

113. **Pisidium huachucanum** Pilsbry & Ferriss.

*Pisidium abditum huachucanum* PILSBRY & FERRISS, *Proc. Acad. Nat. Sci. Philada.*, 1906, p. 173.

Appears to be distinct from *P. abditum*.

*Habitat*.—Arizona, Nevada.

114. **Pisidium occidentale** Newcomb.

*Pisidium occidentale* NEWCOMB, *Proc. Acad. Nat. Sci. Calif.*, II, 1863, p. 94.

*Habitat*.—California, south to San Diego.

115. **Pisidium insigne** Gabb.

*Pisidium insigne* GABB, *Amer. Journ. Conchol.*, IV, 1868, p. 69, Pl. II, fig. 2.

The specimens in the Collection of the Academy of Natural Sciences in Philadelphia (No. 58,155) are evidently immature, but appear to represent a distinct species.

*Habitat*.—California.

116. **Pisidium ashmuni** Sterki.

*Pisidium ashmuni* STERKI, *Nautilus*, XVII, 1903, p. 42.

*Habitat*.—New Mexico, southern California.

117. **Pisidium nevadense** Sterki.

*Pisidium nevadense* STERKI, *Nautilus*, XXVI, 1913, p. 137.

*Habitat*.—Nevada County, California.

118. **Pisidium nevadense modicum** Sterki.

*Pisidium nevadense* var. *modicum* STERKI, *l. c.*

*Habitat*.—White Pine, Nevada.

119. **Pisidium ultramontanum** Prime.

*Pisidium ultramontanum* PRIME, *Mon. Corb.*, 1865, p. 75.

*Habitat*.—British Columbia to California.

120. ***Pisidium randolphi*** Roper.

*Pisidium randolphii* ROPER, *Nautilus*, IX, 1896, p. 99.

*Habitat*.—Washington.

121. ***Pisidium furcatum*** Sterki.

*Pisidium furcatum* STERKI, *Nautilus*, XXVI, 1913, p. 118.

*Habitat*.—Washington.

122. ***Pisidium furcatum* (?) *rhombicum*** Sterki.

*Pisidium* (*furcatum* var. ?) *rhombicum* STERKI, *Nautilus*, XXVI, 1913, p. 119.

*Habitat*.—Washington.

123. ***Pisidium columbianum*** Sterki.

*Pisidium columbianum* STERKI, *Nautilus*, XXVI, 1913, p. 117.

Variable.

*Habitat*.—British Columbia, apparently common.

124. ***Pisidium proximum*** Sterki.

*Pisidium proximum* STERKI, *Nautilus*, XX, 1906, p. 5.

*Habitat*.—British Columbia, Washington.

125. ***Pisidium angelicum*** Rowell.

*Pisidium angelicum* ROWELL, *Proc. Acad. Nat. Sci. Calif.*, III.

The specimens seen by the writer were evidently young, and their identification is somewhat doubtful.

*Habitat*.—California, Angel Island, near San Francisco.

126. ***Pisidium marci*** Sterki.

*Pisidium marci* STERKI, *Nautilus*, XXIII, 1909, p. 42.

Closely resembles *P. loveni* Clessin (= *lilljeborgii* Clessin, *teste* B. B. Woodward) of Europe, and may be identical.

127. ***Pisidium fabale*** sp. nov.

Mussel rather large, subequipartite, barely oblique, moderately inflated, outlines oval to almost elliptical, or posteriorly subtruncate obliquely outward and the supero-anterior slope very slightly marked; in young and adolescent specimens these features are more marked, and there is a distinct angle at the junction of the superior and posterior margins; beaks slightly behind the middle, moderately large, rounded, slightly elevated and little projecting over the hinge margin; scutum slightly or barely marked, narrow, scutellum not noticeable; surface

somewhat shining, with fine, somewhat sharp, crowded, irregular to subregular concentric striae and a few slightly marked lines of growth; color pale corneous to straw or light yellowish, generally with narrow, irregular, alternating zones of these shades; shell thin, fragile, somewhat translucent; inner surface microscopically wavy rugulose, muscle insertions and pallial line distinct; hinge slight, rather short; cardinal teeth: the right curved, thin, its posterior end more or less bifid, left: anterior short, thin, strongly curved, posterior short, oblique, slightly curved to nearly straight, its anterior end extending to barely above the middle of the anterior; laminae rather short, slight, little projecting inward; of the right valve; the anterior inner with its cusp near the middle, little elevated and barely pointed, the outer small and barely one-fourth the length of the inner, posterior similar; left both short with the cusps distal, pointed, somewhat abrupt; ligament rather long, resilium not thick, strongly folded, with the insertions extending rather far downward on the hinge plates.

Long. 8, alt. 6.2, diam. 4.2 mm. (100 : 81 : 52).

Soft parts not examined.

*P. fabale* appears not to be closely related to any of the other N. Am. species, so far as known. It is of about the same size as *P. rowelli* (western) and *alleni* (northeastern), but differs from both in shape and appearance, and the formation of the hinge. It is less inflated, less inequiptartite, the beaks being less posterior, and less elevated.

*Habitat*.—Bitter Root Mountains, Montana, various places. Mr. L. E. Daniels collected several hundred specimens in 1915, and had secured some in 1912. They are of all stages of growth, and fairly constant, except some which appear to be hybrids. The types are from Lost Horse Creek, near Charlos (Carnegie Museum No. 8100).

128. *Pisidium abortivum* sp. nov.

Mussel small, subequiptartite, slightly oblique, sub-quadrangular, moderately inflated; superior and inferior margins little curved, posterior subtruncate to rounded, supero-anterior slope well marked, slightly curved, anterior end rounded-angular, situated well below the longitudinal median line, beaks barely posterior, little elevated, somewhat flattened on top; surface somewhat glossy, with very fine, slight, crowded concentric striae and generally a few slightly marked lines of growth; radial lines, very fine, crowded, irregularly broken,

are over the beaks and extending over about the central one-third of the valves, gradually evanescent; color pale corneous to whitish or straw, shell thin, translucent to opaque; hinge short, slight, plate narrow; cardinal teeth small and slight, the right somewhat curved, its posterior end not or slightly thicker, both in the left valve short, nearly straight, the anterior close to the edge of the plate; laminae: the right anterior, inner with a cusp not abrupt, in about its middle, the posterior quite small with a slightly marked cusp; outer ones both small, about half as long as the inner; left: both small, short, with cusps somewhat distal, rather abrupt, obtusely pointed; ligament and resilium short and slight.

Long. 2.4, alt. 1.8, diam. 1.2 mm. (100 : 75 : 50).

This *Pisidium* is rather inconspicuous and has hardly any striking features. The mussel appears to be the young of some other species, but hundreds of specimens from nepionic to manifestly adult prove its being distinct. It shows little variation, except in the form noted below. In size and shape it is somewhat like a form of *splendidulum*, but in other respects is markedly different; in color and appearance it somewhat resembles *imbecille*, but the latter is somewhat more elongate and more inflated, the superior margin is more curved, the beaks are narrower and more prominent.

*Habitat*.—Bitter Root Mountains, Montana, at various places, collected by Mr. L. E. Daniels, in 1912 and 1915. The types are from Lost Horse Creek, near Charlos (No. 8103, Carnegie Museum).

129. ***Pisidium abortivum exiguum*** var. nov.

Smaller than *abortivum*, more inflated, outlines somewhat more rounded, surface more glossy and striae finer, colorless-glossy to whitish. Long. 1.6, alt. 1.2, diam. 1 mm. A number of specimens, in the type lot of *abortivum*, were thus noticeably different, from young to adult, and plainly represent a variety, or subspecies, not merely individual variation (No. 8105, Carnegie Museum).

130. ***Pisidium hannai*** Sterki.

*Pisidium hannai* STERKI, *Proc. U. S. National Mus.*, 1916, p. —.

*Habitat*.—St. Paul Island, Pribilof Islands, Bering Sea.

131. ***Pisidium singleyi*** Sterki.

*Pisidium singleyi* STERKI, *Nautilus*, XI, 1898, p. 112.

Apparently belongs to a group of neotropical *Pisidia*, found in the West Indian Islands, and Central and South America.

*Habitat*.—Alabama to Texas, Mexico, Guatemala.

132. *Pisidium guatemalense* sp. nov.

Mussel of medium size, moderately and rather evenly inflated, of elliptical outlines without any projecting angles; beaks somewhat posterior (two fifths from the posterior end), rather small, rounded, slightly projecting over the upper margin; surface glossy, with slight, crowded, irregular striæ; color pale corneous, shell transparent, thin, very fragile; hinge rather short, very slight, plate narrow; cardinal teeth small, the right curved, thin, its posterior end bifid with the shanks divergent and curved downward; the left anterior strongly curved, almost conduplicate, pointed, the posterior oblique nearer the longitudinal line, nearly straight, extending forward to over the middle of the anterior; laminae thin, the right anterior: inner with short, pointed cusp, the outer about half the length, posterior small, rounded, the outer small and short; left anterior and posterior with rather small, abrupt, pointed cusps placed distally; ligament and resilium rather long and slight, uncovered along the median line.

Long. 5.2, alt. 4.3, diam. 2.7 mm. (100 : 83 : 52).

It is a precarious thing, with Sphæriidæ, to establish a species on one or a few specimens. But these two were exactly alike and apparently normal; the hinge is of such unique formation and the shape so different from others known, that there can be no doubt that the species is distinct.

*Habitat*.—Conchas River, Quirigua, Guatemala, collected by Mr. A. A. Hinkley, in whose collection the type specimen is.

## PISIDIA NOT SEEN BY THE WRITER.

133. *Pisidium tremperi* Hannibal.

*Pisidium tremperi* HANNIBAL, *Proc. Mal. Soc.*, X, 1912, p. 137, Pl. VII, fig. 22.

San Bernardino Mountains, California. Apparently near *P. ashmuni*.

134. *Pisidium arcticum* Westerlund.

*Pisidium arcticum* WESTERLUND, *Nachrichtsbl. Deutsch. Malak. Gesellsch.*, 1883, p. 58.

*Habitat*.—Port Clarence, Alaska.

135. *Pisidium nivale* Westerlund.

*Pisidium nivale* WESTERLUND, *l. c.*

*Habitat*.—Port Clarence, Alaska.



136. **Pisidium glaciale** Westerlund.

*Pisidium glaciale* WESTERLUND, *l. c.*

The foregoing three species are cited from Dall, *Alaska, Mollusca*, p. 144.

137. **Pisidium pulchellum** (Jenyns).

*Cyclas pulchella* JENYNS, *Trans. Phil. Soc. Cambridge*, 1832, p. 306, Pl. XXI, fig. 1.  
*Pisidium pulchellum* B. B. WOODWARD, *British Pisidia*, 1913, p. 78, figs.

*Habitat*.—Methy Lake, Athabaska (Richardson), Dall, *l. c.* Should be verified.

138. **Pisidium mesæ** Theo. D. A. Cockerell.

*Pisidium mesæ* THEO. D. A. COCKERELL, *Journ. of Conchol.*, 6, p. 65 (named, not described; the specimen is in the British Museum).

*Habitat*.—Colorado.

139. **Pisidium harfordianum** Prime.

Apparently not described; but specimens under that name are in collections. Roper, in *The Nautilus*, IX, p. 99, states that Dr. J. G. Cooper says that "*harfordianum* is most nearly resembling *P. ran-dolphii* Roper." In the U. S. National Museum are a few specimens of "*P. harfordianum* Prime," quite different. Eventually it might be best to drop the name.

140. **Pisidium saginatum** White.

*Pisidium saginatum* WHITE, Powell's *Geology of the Uinta Mountains*, 1876, p. 128.

*Fossil*.—Upper Cretaceous lignite, Evanston, Utah.

**Pisidium mighelsianum** Clessin, Monogr. Cycladeen, in Martini-Chemnitz, 1879, pp. 49, 57.

The author of the species in a letter received from him and dated February 7, 1899, expressed the desire to have the species dropped. What it had been, the writer could not ascertain.

## GROUPING OF THE SPECIES.

## Genus SPHÆRIUM.

The genus has been divided into three subgenera:

SPHÆRIASTRUM Bourguignat, of which the type and only species is *S. rivicola* (Leach) of Europe. Clessin has included *S. sulcatum*, but it evidently belongs to the following subgenus:

CYRENASTRUM Bourguignat, type *S. solidum* Normand, of Europe; and including Nos. 1-30 of this Catalog;

CORNEOLA Clessin, type *S. corneum* (Linné). Nos. 34-37, and probably Nos. 31-33 of the foregoing Catalog.

#### Genus MUSCULIUM.

This is a well-defined genus, although the principal distinguishing features cited by authors (high, "tubular" beaks, calyculate) do not hold good. Subgenera cannot be defined, but there are about three more or less well-marked groups.

#### Genus PISIDIUM.

Various attempts have been made to divide the *Pisidia* into subgenera or sections. Some of the divisions proposed are too artificial, founded on arbitrarily chosen and partly mistaken features. Some of the proposed groups have been too narrowly defined, or, on the other hand, based upon too sweeping generalizations. Clessin's groups *Fluminina*, *Rivulina*, and *Fossarina* suffer from these defects, nevertheless appear to point out a natural arrangement. Accepting Clessin's arrangement with some changes and additions, the subjoined grouping is tentatively proposed. *Fontinalina* may again require modification. More detailed definition and discussion will be found elsewhere.

FLUMININA Clessin, type *P. amnicum* (Müller), and *P. virginicum* (Gmelin). This is a natural group, although the main distinguishing feature relied upon by its author proved to be based upon a mistake, the right valve having only one cardinal tooth, and not two teeth, as he supposed.

LACUSTRINA Sterki, type *P. idahoëense* Roper.

RIVULINA (Clessin) Sterki, type *P. supinum* A. Schmidt, of Europe. Clessin included *P. compressum* Prime. Nos. 5-28, inclusive, of the foregoing catalog plainly fall into this division, and also Nos. 29-33 (or 37); possibly also Nos. 38-40, inclusive.

FONTINALINA Sterki, type *P. fontinale* Pfeiffer (+ *abditum* Haldeman). To this group belong many related palearctic *Pisidia*, and our Nos. 41-85, and apparently also Nos. 86-101.

FOSSARINA Clessin (restricted), type *P. obtusale* Pfeiffer, our Nos. 102-111, characterized by a slight, short hinge, with very abrupt,

spine-like cusps of the laminae, belong here. Clessin included under *Fossarina* all *Pisidia* except *Fluminina* and *Rivulina*, as understood by him—an aggregation of very heterogeneous forms.

Nos. 112–129 of the preceding catalog are western *Pisidia*, the affinities of which are not evident at the present time. No. 131 appears to belong to a group represented by Central American and West Indian *Pisidia*.

ALPHABETICAL LIST AND INDEX OF THE SPECIES AND VARIETIES OF THE  
SPHÆRIIDÆ ENUMERATED IN THE FOREGOING CATALOG.

N. B. The numbers refer to the number prefixed to the name of the species, variety, or subspecies in the catalog, and not to the page upon which the name appears.

## Genus SPHÆRIUM.

<i>acuminatum</i> Prime. . . . .	14	<i>declive</i> Sterki. . . . .	22
<i>aureum</i> Prime. . . . .	6	<i>elevatum</i> Haldeman. . . . .	1
<i>californicum</i> Clessin. . . . .	30	<i>ferrissi</i> Sterki. . . . .	8
<i>crassum</i> Sterki. . . . .	5	<i>florissantense</i> Cockerell. . . . .	33
<i>dentatum</i> Haldeman. . . . .	26	<i>hodgsoni</i> Sterki. . . . .	4
<i>emarginatum</i> Prime. . . . .	12	<i>jayense</i> Prime. . . . .	10
<i>fabale</i> Prime. . . . .	22	<i>lacustre</i> Müller. . . . .	19
<i>flavum</i> Prime. . . . .	21	<i>lenticula</i> Gould. . . . .	31
<i>formosa</i> (Cyclas) Meek & Hayden. . . . .	42	<i>novoleonis</i> Pilsbry. . . . .	9
<i>hendersoni</i> Sterki. . . . .	28	<i>orbiculare</i> Sterki. . . . .	2
<i>jalapense</i> Pilsbry. . . . .	24	<i>partumeium</i> Say. . . . .	11
<i>lilycashense</i> Baker. . . . .	18	<i>v. cæruleum</i> Prime. . . . .	12
<i>lineatum</i> Sterki. . . . .	7	<i>v. eburneum</i> Anthony. . . . .	15
<i>modestum</i> Prime. . . . .	20	<i>v. globosum</i> Sterki. . . . .	13
<i>mormonicum</i> Sowerby. . . . .	39	<i>v. mirabile</i> Prime. . . . .	14
<i>nobile</i> Gould. . . . .	31	<i>parvum</i> Sterki. . . . .	29
<i>occidentale</i> Prime. . . . .	35	( <i>pusillum</i> Sterki). . . . .	23
<i>v. amphibium</i> Sterki. . . . .	36	<i>raymondi</i> Cooper. . . . .	24
<i>ohioense</i> Sterki. . . . .	19	<i>rosaceum</i> Prime. . . . .	20
<i>patella</i> Gould. . . . .	33	<i>v. fuliginosum</i> Sterki. . . . .	21
<i>pilsbryanum</i> Sterki. . . . .	25	<i>v. deforme</i> Carpenter. . . . .	20
<i>planum</i> Meek & Hayden. . . . .	41	<i>ryckholli</i> Normand. . . . .	23
<i>primeanum</i> Clessin. . . . .	32	<i>securis</i> Prime. . . . .	26
<i>rectiardinale</i> Meek & Hayden. . . . .	40	<i>sphæricum</i> Anthony. . . . .	27
<i>rhomboideum</i> Say. . . . .	34	<i>v. succineum</i> Sterki. . . . .	28
<i>solidulum</i> Prime. . . . .	8	<i>subtransversum</i> Prime. . . . .	7
<i>spokani</i> Baird. . . . .	29	<i>transversum</i> Say. . . . .	5
<i>stamineum</i> Conrad. . . . .	9	<i>v. decisum</i> Sterki. . . . .	6
<i>v. forbesi</i> Baker. . . . .	10	<i>truncatum</i> Linsley. . . . .	16
<i>v. wisconsinense</i> Sterki. . . . .	11	<i>v. albidum</i> Sterki. . . . .	17
<i>striatinum</i> Lamarck. . . . .	16	<i>v. angustatum</i> Sterki. . . . .	18
<i>v. corpulentum</i> Sterki. . . . .	17	<i>uintaense</i> Call. . . . .	32
<i>subelliptica</i> (Cyclas) Meek & Hayden. . . . .	43	<i>winkleyi</i> Sterki. . . . .	25
<i>sulcatum</i> Lamarck. . . . .	1		
<i>v. albescens</i> Sterki. . . . .	2		
<i>v. insigne</i> Sterki. . . . .	3		
<i>v. planatum</i> Sterki. . . . .	4		
<i>tenuis</i> Prime. . . . .	37		
<i>v. walkeri</i> Sterki. . . . .	38		
<i>torsum</i> Sterki. . . . .	13		
<i>triangulare</i> Say. . . . .	23		
<i>tumidum</i> Baird. . . . .	27		
<i>vermontanum</i> Prime. . . . .	15		

## Genus MUSCULUM.

<i>australe</i> Sterki. . . . .	30		
<i>contractum</i> Prime. . . . .	3		

## Genus EUPERA.

<i>cubensis</i> Prime. . . . .	1
<i>singleyi</i> Pilsbry. . . . .	2

## Genus PISIDIUM.

<i>abditum</i> Haldeman. . . . .	77
<i>v. lacteum</i> Sterki. . . . .	78
<i>abortivum</i> Sterki. . . . .	128
<i>v. exiguum</i> Sterki. . . . .	129
<i>abyssorum</i> (Stimpson) Sterki. . . . .	96
<i>adamsi</i> Prime. . . . .	41
<i>v. affine</i> Sterki. . . . .	42
<i>æquilaterale</i> Prime. . . . .	29
<i>alleni</i> Sterki. . . . .	70
<i>amnicum</i> Müller. . . . .	2

<i>angelicum</i> Rowell. . . . .	125	<i>v. clarum</i> Sterki. . . . .	108
<i>arcticum</i> Westerlund. . . . .	134	<i>v. minutum</i> Sterki. . . . .	109
<i>ashmuni</i> Sterki. . . . .	116	<i>mesæ</i> Cockerell. . . . .	138
<i>atlanticum</i> Sterki. . . . .	54	( <i>mighelsianum</i> Clessin). End of Catalog	
<i>v. albidum</i> Sterki. . . . .	56	<i>milium</i> Held. . . . .	91
<i>v. dispar</i> Sterki. . . . .	55	<i>minus</i> Adams. . . . .	69
<i>columbianum</i> Sterki. . . . .	123	<i>minusculum</i> Sterki. . . . .	38
<i>complanatum</i> Sterki. . . . .	72	( <i>mirabile</i> Clessin). . . . .	33
<i>compressum</i> Prime. . . . .	5	<i>monas</i> Sterki. . . . .	95
<i>v. arrosum</i> Sterki. . . . .	9	<i>neglectum</i> Sterki. . . . .	59
<i>v. confertum</i> Sterki. . . . .	11	<i>v. corpulentum</i> Sterki. . . . .	60
<i>v. contrarium</i> Sterki. . . . .	14	<i>nevadense</i> Sterki. . . . .	117
<i>v. coosaëse</i> Sterki. . . . .	13	<i>v. modicum</i> Sterki. . . . .	118
<i>v. curvatum</i> Sterki. . . . .	7	<i>nivale</i> Westerlund. . . . .	135
<i>v. illinoisense</i> Sterki. . . . .	15	<i>noveboracense</i> Prime. . . . .	44
<i>v. levigatum</i> Sterki. . . . .	12	<i>v. alabamense</i> Sterki. . . . .	49
<i>v. opacum</i> Sterki. . . . .	6	<i>v. expansum</i> Sterki. . . . .	45
<i>v. pellucidum</i> Sterki. . . . .	8	<i>v. fraternum</i> Sterki. . . . .	48
<i>v. rostratum</i> Sterki. . . . .	10	<i>v. lineatum</i> Sterki. . . . .	47
<i>contortum</i> Prime. . . . .	92	<i>v. quadrulum</i> Sterki. . . . .	46
<i>v. triangulare</i> Sterki. . . . .	93	<i>occidentale</i> Newcomb. . . . .	114
<i>costatum</i> Sterki. . . . .	110	<i>ohioëse</i> Sterki. . . . .	85
<i>cruciatum</i> Sterki. . . . .	18	<i>overi</i> Sterki. . . . .	64
<i>cuneiforme</i> Sterki. . . . .	66	<i>ovum</i> Sterki. . . . .	102
<i>elevatum</i> Sterki. . . . .	50	<i>pauperculum</i> Sterki. . . . .	98
<i>fabale</i> Sterki. . . . .	127	<i>v. crystalense</i> Sterki. . . . .	100
<i>fallax</i> Sterki. . . . .	20	<i>v. nylanderi</i> Sterki. . . . .	99
<i>v. mite</i> Sterki. . . . .	21	<i>v. sulphureum</i> Sterki. . . . .	101
<i>v. septentrionale</i> Sterki. . . . .	22	<i>politum</i> Sterki. . . . .	74
<i>ferugineum</i> Prime. . . . .	111	<i>v. decorum</i> Sterki. . . . .	75
( <i>fontinale</i> Pfeiffer). . . . .	78	<i>proximum</i> Sterki. . . . .	124
<i>fraudulentum</i> Sterki. . . . .	30	<i>pulchellum</i> Jenyns. . . . .	137
<i>v. peraltum</i> Sterki. . . . .	31	<i>punctatum</i> Sterki. . . . .	24
<i>friersoni</i> Sterki. . . . .	53	<i>v. armatum</i> Sterki. . . . .	25
<i>fuscatum</i> Sterki. . . . .	121	<i>v. simplex</i> Sterki. . . . .	26
<i>v. rhombicum</i> Sterki. . . . .	122	( <i>pusillum</i> Gmelin). . . . .	59
<i>glabellum</i> Sterki. . . . .	39	<i>randolphi</i> Roper. . . . .	120
<i>glaciale</i> Westerlund. . . . .	136	<i>regulare</i> Prime. . . . .	51
<i>guatemalense</i> Sterki. . . . .	132	<i>v. danielsi</i> Sterki. . . . .	52
<i>handwerki</i> Sterki. . . . .	28	<i>roperi</i> Sterki. . . . .	71
<i>hannai</i> Sterki. . . . .	130	<i>roseum</i> Scholtz. . . . .	78
<i>harfordianum</i> Prime. . . . .	139	<i>rotundatum</i> Prime. . . . .	103
<i>henslowianum</i> Sheppard. . . . .	17	<i>rowelli</i> Sterki. . . . .	112
<i>hinkleyi</i> Sterki. . . . .	23	<i>saginatam</i> White. . . . .	140
<i>huachuacanum</i> Pilsbry & Ferriss. . . . .	113	<i>sargenti</i> Sterki. . . . .	43
<i>idahoëse</i> Roper. . . . .	3	<i>scutellatum</i> Sterki. . . . .	62
<i>v. indianense</i> Sterki. . . . .	4	<i>singleyi</i> Sterki. . . . .	131
<i>imbecille</i> Sterki. . . . .	94	<i>spharicum</i> Sterki. . . . .	40
<i>inornatum</i> Sterki. . . . .	83	<i>splendidulum</i> Sterki. . . . .	86
<i>insigne</i> Gabb. . . . .	115	<i>v. corneolum</i> Sterki. . . . .	87
<i>kirklandi</i> Sterki. . . . .	19	<i>v. miliastrum</i> Sterki. . . . .	80
<i>latchfordi</i> Sterki. . . . .	32	<i>v. novangliæ</i> Sterki. . . . .	88
<i>lermondi</i> Sterki. . . . .	90	<i>steenbuchi</i> Möller. . . . .	68
<i>levissimum</i> Sterki. . . . .	96	<i>streatori</i> Sterki. . . . .	76
<i>limatum</i> Sterki. . . . .	27	<i>strengi</i> Sterki. . . . .	73
<i>mainense</i> Sterki. . . . .	65	<i>subrotundum</i> Sterki. . . . .	79
<i>marci</i> Sterki. . . . .	126	<i>v. canadense</i> Sterki. . . . .	80
<i>medianum</i> Sterki. . . . .	107	<i>v. olofi</i> Sterki. . . . .	81



<i>v. pumilum</i> Sterki.....	82	<i>v. brevius</i> Sterki.....	35
<i>succineum</i> Sterki.....	61	<i>v. cicer</i> Pirne.....	34
<i>superius</i> Sterki.....	67	<i>v. hybridum</i> Sterki.....	37
<i>supinum</i> A. Schmidt.....	16	<i>v. magnum</i> Sterki.....	36
<i>tenuissimum</i> Sterki.....	97	<i>ventricosum</i> Prime.....	104
<i>trapezoideum</i> Sterki.....	57	<i>vesiculare</i> Sterki.....	105
<i>v. protensum</i> Sterki.....	58	<i>v. striatellum</i> Sterki.....	106
<i>tremperi</i> Hannibal.....	133	<i>vexum</i> Sterki.....	84
<i>ultramontanum</i> Prime.....	119	<i>virginicum</i> Gmelin.....	1
<i>variabile</i> Prime.....	33	<i>walkeri</i> Sterki.....	63

XVII. SOME DIRECTIONS AND SUGGESTIONS FOR COLLECTING THE SPHÆRIIDÆ AND AQUATIC GASTROPODS.

BY VICTOR STERKI, M.D.

The Sphæriidæ, our smallest fresh-water Pelecypoda, or bivalves (mussels), are very interesting objects of study. They have been somewhat neglected on account of their generally small size and the apparent difficulty of securing them. They are also somewhat difficult to identify, principally because of the considerable variation which reveals itself among them. At present there are over two hundred species and varieties known from North America, belonging to the genera *Sphærium*, *Musculium*, *Eupera*, and *Pisidium*. Their many varieties and forms make them all the more interesting, because of the questions which they raise as to systematic arrangement and distribution. The largest are about 20 mm. long (*Sphærium sulcatum*); the smallest 1.5-2 mm. (*Pisidium punctatum*, and some others).

They are approximately well-known from only some small parts of the continent. Few places have been systematically and thoroughly searched, and there are stretches of hundreds and thousands of square miles where only a little sporadic collecting has been done, and equally large areas in which no collections at all have been made. There are therefore chances almost anywhere to secure valuable material for a collection and at the same time to aid the specialist in studying them. The same, to a large extent, may be said of the aquatic gastropods, or snails. They are generally associated, and the methods of collecting them are essentially the same.

WHERE FOUND.

They live in waters of all kinds, and no place should be neglected, or overlooked, especially since different species and forms are found in different habitats. Lakes, ponds, rivers, and sloughs, canals, ditches, springs, and even the smallest rills, sink-holes, swamps, and marshes, even miry puddles, all yield some of these mollusks. Waters

full of aquatic plants, estuaries, drainage-ditches, etc., are especially rich in mollusks. Some of the smallest and rarest *Pisidia* live among gravel in rivers and creeks. Tidal waters are often rich. In a small tidal ditch in Virginia large numbers of specimens of about thirty-five species of mollusks were collected in less than two hours, and about a dozen of them were Sphæriidæ. Brackish waters should be searched over carefully and may yield peculiar forms.

Many species and forms are often found abundantly in the mountains, even at altitudes of 10,000 to 12,000 feet above sea-level, and quite a number of species have been collected within the Arctic Circle. Some apparently promising places may be poor, yet yield interesting forms; others are immensely rich. In some instances over twenty thousand specimens of *Pisidium* alone have been taken from a single locality in a short time, representing many species, some of them common, others very scarce. All this shows that collecting should be done *thoroughly* at every available place, so as to secure large numbers of specimens, and all species inhabiting that place so far as possible.

Some Sphæriidæ are able to live and propagate in damp places, under and between dead leaves, in muck, where water abounds only in spring, or after heavy rains; and such forms are able even to survive severe droughts lasting weeks and months, as for instance *Sphærium occidentale*, usually found in company with certain aquatic snails. Some *Pisidia* may be found among moss in damp or wet places and around springs.

It is worthy of note that different regions have their peculiar forms differing from each other. The molluscan fauna of the Pacific States differs materially from that of the Atlantic States, and the fauna of the South from that of the North.

#### COLLECTING OUTFIT.

Some of the larger mussels and snails may be found and picked up singly, but in general they must be collected "wholesale." Various kinds of perforated metal and wire strainers have been used, some of them ingeniously constructed, but they are not satisfactory. The best and the simplest thing is a net, somewhat like a butterfly-net. A piece of strong wire,  $3/16$  in. in diameter, and about four feet long, is bent so as to form a ring of six to eight inches in diameter; the ends, or shanks, are crossed over each other, and the longer end is bent

back over the shorter (*see cut*); this may serve for a handle, but it is better to fasten it to a wooden handle, about three feet long, *e. g.*, a broomstick, planed down somewhat at one end to the length of



FIG. 1. Method of making a cheap ring for a collecting net.

the wire handle, and with a groove around it, about half-an-inch from the end. The wire frame can be tied to the handle with stout twine. To the wire ring is fastened a sack-net, twelve to fifteen inches long, of good, somewhat loose, burlap, which is the best and cheapest material, and procurable almost anywhere. The seams must be sewn well, best doubly, with good linen thread, and the rim over the wire should be protected by a strip of strong canvas, to prevent its being worn through in a short time. Such a net, or two of them, take little space, and a stick for a handle may be found and fitted anywhere. Some small muslin sacks should be taken along, a piece or two of muslin about a yard square, and some small boxes and vials, and, for a longer trip, a bottle with a few ounces of alcohol. This is almost everything needed for good work. High rubber boots are desirable, even necessary. Besides, it is recommended to take a small hoe (Ferriss' hoe) along. It is handy in many ways, especially for collecting land-snails. The hoe and the net with its handle, tied together, are not very cumbersome.

#### COLLECTING.

As stated before, some snails and mussels may be picked up with the hand. Many of the former are seen clinging on rocks, stones, or wood. Some *Musculia* may be found on pieces of wood covered with mosses and algæ; they must be taken up carefully lest their thin and fragile shells be crushed. Special care is needed in collecting the small and tender, flat-shelled species of *Ancylus* and *Gundlachia*. They are found on plants such as the stalks and leaves ("pads") of water-lilies, the leaves of *Typha*, *Sparganium*, *Sagittaria*, etc.; also on dead and living shells, stones, etc. The best way is to take them

up with a knife-blade, or to cut off pieces of the plants with the snails on them.

With the net the surface-layer of the bottom in pools and streams is carefully scooped or scraped up, and when a good quantity is gathered the net is shaken in the water, dipped repeatedly to the rim, and worked with the hand to wash out mud and fine sand. Of the coarser material, plants, debris, etc., handful after handful is taken from the top, while the net is held in the water to near its rim, washed, shaken, then looked over and thrown away. The remaining finer material, generally a small quantity, with the mollusks, is then put into some receptacle, best a muslin sack. Haul after haul is made from a place, and then a label is added to the "washings," noting the place, its nature, and the date.

Where there are thick, tangled masses of plants, like *Potamogeton*, *Ceratophyllum*, *Philotria*, *Vallisneria*, etc., along the shores of ponds, small lakes, or bays, the plants may be pulled out with a rake, slowly and carefully, put into a wash-tub, if within reach, and washed out there. After a number of hauls the water is poured off and the settlings are put in the net to be washed free from mud and fine sand. A large sack mounted on a wire ring or hoop and supported by a few forked sticks, hanging in the water, is also serviceable and more easily carried along than a tub. Even a hole dug in the ground at the water's edge will answer the purpose. After a place has been raked over the net may be used to gather what has dropped to the bottom.

At similar places away from shore collecting is done from a boat or launch. The net is driven and swung through the masses of plants and over the bottom, where it can be reached. Good results may be obtained in this way; but, where there is an old accumulation of muck, mollusks are generally scarce. Where a spring or brook enters a lake or pond the harvest will usually be rich, and such places may be more easily accessible from a boat than by wading out from the shore.

For collecting in water about four to eight feet deep the net may be tied to a long pole; a dredge is preferable, but cannot be used where the bottom is obstructed by plants, pieces of wood, etc. In deeper water dredging is the only means for collecting, and should be used more extensively. A small dredge can easily be made of a metal frame two to three feet long and about one foot wide, or larger, with a burlap sack attached, preferably protected by outer flaps of leather



or strong canvas, twill, or jean. The "Holland dredge" (*cf.* Memoirs Carnegie Museum, Vol. IV, p. 281) modified, with a small wheel on each side of the frame, will prove very serviceable.

A good deal of dredging has been done in European lakes, and many deep-water species, or forms, especially of *Pisidium*, have been brought up in this way. It is time that we explore our lakes, especially the Great Lakes. To judge from what has been secured by some dredging in Lake Michigan good results may be expected. Some deep water mollusks have also been taken from the stomachs of white-fish, and it seems worth while to follow that trail.

From dead leaves, moss, etc., specimens may be picked out, or a portion of such material may be taken along; or better still, if water is near, carried to it and its contents washed out. Such material may also be dried and then its contents secured by sifting.

On gravelly bottoms of rivers and creeks, where the net cannot be directly used, there are other methods of procedure. Where there is a strong current in shallow water, as on bars and riffles, a hole a foot or two deep may be dug out; above it some furrows converging and leading into it are made. Then the gravel upstream over a wide stretch should be well stirred and the current will carry the smaller and lighter particles down. From the hole the material thus gathered is then taken out with the net and washed. If there is anybody to help, the net can be held in the lower furrow to take up what the current carries along. In this way large numbers of specimens not otherwise obtainable can be secured, often representing rare species, *e. g.*, *Pisidium cruciatum* (2 mm. long), also various small gastropods and very young Naiades. By the way, the same method may be used for collecting certain crustacea, insects, etc.

When the water in rivers is quite low, there may be isolated pools and waterholes along the shore where mollusks are aggregated in great numbers, principally snails. There they sometimes can be gathered by the quart. Not only a good supply of the larger forms should be taken along, but the net should be used to secure the smaller and minuter specimens.

#### SEASONS.

Collecting may be done at any time of the year, even in mid-winter, and good things have even been secured with the net through holes cut in the ice. For obvious reasons, most may be accomplished in

late summer and fall. It is desirable that accessible places be visited at various seasons, especially for *Musculium*, of which at least a large part become full-grown, and then die in early summer to midsummer, the time when also most of the *Lymnæa*, *Planorbis*, *Physa*, etc., attain maturity. A large percentage of *Musculia* now in collections are immature, and it appears that of some forms only young and half-grown specimens are known. In some instances observations have been made and series of specimens at successive stages of growth were secured by collecting at the same places every few weeks from spring to midsummer, or fall. It will also be interesting to compare observations made in this respect in the North and in the South.

#### DRIFT.

Fine drift on the shores and beaches of lakes, accumulated in heaps and rows, or thinly scattered, almost always contains shells. Though generally more or less bleached and waterworn they are well worth taking. From drift-heaps good quantities should be taken along. Scattered specimens on the beach may be swept on to a piece of cardboard or tin with a feather.

Drift accumulated along rivers, creeks, or ravines after floods and heavy rains, from a handful or less to large heaps, are always worth taking. A sieve, if at hand, will help in separating the coarser material from the finer. Most of the shells it contains are generally of small land-snails, often thousands of them, but some aquatic mollusks are usually also found.

#### FOSSILS.

Fossil specimens should be collected wherever possible from the fresh-water deposits of the Tertiaries and older formations, from which very few so far are extant. Valuable material should be found especially in the Western States. It is barely necessary to say that they should be handled very carefully, since the shells are thin and fragile, and that not only the locality should be noted, but also the formation and stratum.

Marl deposits, in a number of states, have been more or less explored, and many of them are wonderfully rich in shells of the Sphæriidæ and Gastropods. Generally the marl is so soft that the shells can be washed out of it with proper care, and thus it is possible to take good quantities along to be worked up at home.

## WORKING UP.

The "washings" brought home, or to camp, should be looked over as soon as convenient, especially in hot weather, and spread out for preliminary drying, preferably on a sheet of muslin. Larger *Sphæria* and *Musculia* may be picked out at once, cleaned if necessary, and put into alcohol diluted with from 75 to 60 per cent. of water for a day or two. After that such as are wanted for future examination of the soft parts are put in somewhat stronger alcohol. The others can be easily dried, while with fresh ones there is danger of putrefaction. Using alcohol is preferable to scalding in hot water, then removing the soft parts and closing the shells with mucilage or glue. Even drying without alcohol is better if there is a chance for doing so. Larger snails wanted for anatomical examination are also put in alcohol or some other preserving fluid; the others may be treated in the usual way, by scalding and extracting the soft parts, which again may be preserved by themselves, in which case they require exact labeling. The opercula of operculate snails, such as *Viviparidæ*, etc., should be kept either with their soft parts or the shells, but not glued into the apertures.

When the washings are somewhat dry, so that they can be crumbled up, the specimens may be picked out and then put to final drying. It is difficult or impossible to find the smallest mussels and snails in damp clogging debris, and takes much more time. Generally it is preferable to dry the washings thoroughly, and then they may be kept for being worked up at some convenient time, but never without the label indicating the place and date at which the material was taken. Larger *Sphæriidæ* and snails, if not treated with alcohol, require a day or two to become quite dry, in moderate heat; too great heat will brown them and crack the shells of *Musculium*.

After a season's collecting, or even after an extended trip, there may be a large number of lots of washings, siftings, drift, etc., on hand, and it is desirable to have on each parcel a conspicuous outside label denoting its origin.

If there is a good portion of washings, or drift, a sieve is a great help for separating finer from coarser material, and two, of different meshes, may be preferable. If not provided with sieves, shaking to and fro on a piece of paper or cardboard is the next best method of treatment. Material may be spread on a table and the specimens

picked out with a fine pair of pincers. A number of small boxes or trays should be kept on hand for different species, or at least genera or groups, and thus time and work will be saved. Even the smallest specimens should be taken. Valuable material has been thrown away on the supposition that the specimens were "only young and of no account." Even the young are desirable, and so to some extent are dead shells. *Musculia*, to repeat, must be handled carefully, because many of them have very thin and fragile shells. *Pisidia* in particular are frequently incrustated with a ferruginous deposit, sometimes so thick that they appear to be globules of dirt, and it takes a trained eye to recognize them. While fresh and living they can be cleaned by putting them in a vial with some clean, sharp sand and a little water, and shaking vigorously. A single specimen, fresh or dry, with not too thin a shell, can be cleaned by rolling between moistened thumb and finger, with some sand; a small glass with water and another with sand, side by side on the table, have proved useful.

When the specimens are picked out, separated, and identified so far as can be done, they are put up in vials rather than in boxes, except in the case of large lots, labeled, with or without the name, but with the place of origin, catalogued, and filed in the collection. If the label is not in the container, a small slip of paper should be added with the serial entry number of the label, to prevent misplacing. On larger specimens in the collection the number should be written.

The beginner will have some difficulty in identifying his specimens, and even the more advanced student may be in the same position with respect to some groups, *e. g.*, the *Sphæriidæ*. The best way is to send them to an expert or specialist; it will at the same time aid the latter in his studies.

#### SENDING SPECIMENS FOR IDENTIFICATION.

When specimens are sent for examination it is best to leave those of a genus or group from each locality mixed up, only separated for gross differences of size. This often makes the work easier, and gives an opportunity for studying the species and the extent of their variation, also the influence of the habitat. It goes without saying that separated lots may be sent for identification or verification, and it is recommended that all specimens of a lot be sent; very often a few have been forwarded with the request to name them, while the balance was kept, on the supposition that they were all of the same kind, and to be proved later a mixture of several species.

The labels should indicate not only the localities, but also some notes on the nature of the habitat, just as in the collection. Labels saying "Buffalo, N. Y.," or "Snark County, Kansas," are sadly inadequate. It is also a great help if the labels or numbers are placed conspicuously. If the labels cannot be placed with the specimens, number-slips are put in, corresponding with the numbers on a list sent along. Specimens packed in a vial or box, not filling it, should be protected from jarring by adding a loose wad of cotton; but care should be taken in the case of *Musculia* not to stuff the cotton in so tightly as to crush the specimens. Shells not perfectly dry should never come in contact with cotton. The fibers stick to them and are difficult to remove. When necessary to fill out or pad a vial a small piece of sponge is serviceable.

Whole washings, "dirt and all," may be sent and will be welcome, either dried or fresh, if the weather is not too hot, or the distance not too great. But materials not thoroughly dry should not be in tight containers, such as tin boxes or cans. Drift and siftings will also be gladly received. The specimens will be separated, named, and returned. Where they are in sufficient numbers some specimens will be kept for records and for further study and comparison.

NEW PHILADELPHIA, OHIO,

May 1, 1916.



XVIII. THE LEPIDOPTERA OF THE ISLE OF PINES,  
BEING A LIST OF THE SPECIES COLLECTED ON  
THE ISLAND BY MR. J. L. GRAF AND MR. G. A.  
LINK, SR., IN 1910 AND 1912-1913.

BY W. J. HOLLAND.

The present paper is the first of a series of lists in which it is proposed to enumerate the species of insects belonging to various orders, which were collected upon the Isle of Pines by the party of gentlemen, who went thither in the spring of 1910 in the interest of the Carnegie Museum, and by Mr. G. A. Link, Sr., during his stay upon the island from the spring of 1912 to the beginning of June, 1913. Mr. Link was a member of the party which made collections in 1910, but the entomological specimens, which were brought home at that time, were principally assembled by Mr. J. L. Graf. They consisted chiefly of Lepidoptera and Odonata. Mr. Link during his stay of more than a year upon the island devoted himself almost entirely to collecting birds, as is stated by Mr. W. E. C. Todd in his paper upon the avifauna of the island, which is published in this volume of the ANNALS. Incidentally he gathered specimens of such insects as he encountered at times when he was not otherwise engaged. The specimens in the possession of the Carnegie Museum are under the circumstances the result of more or less desultory collecting, and seem scarcely to adequately represent what must be a rather rich fauna, if we are justified in drawing conclusions from what we know of the wealth of insect-life which is found in Cuba. The lepidoptera, upon which the writer is now reporting, are, however, the first taken on the island which have been systematically listed, and the following pages may lay foundations for more complete lists in the future.

A brief visit to the United States National Museum about the middle of May, 1916, afforded an opportunity to look over the collections from the Antilles, which are there preserved, and acknowledgment is due to the various gentlemen in charge and particularly to Mr. August Busck for the very kind assistance which he accorded the writer in facilitating access to the Lepidoptera contained in that

storehouse of knowledge. Thanks are also due to Dr. Henry S. Skinner of the Academy of Natural Sciences in Philadelphia for devoting a number of his precious hours to helping the writer to consult the classic collections contained in that justly famous institution, where is preserved, among other things, a set of the insects of Cuba named by the late Dr. Gundlach who was in his day the leading authority upon the entomology of the island.

Order **LEPIDOPTERA**.

Suborder *RHOPALOCERA*.

Family *NYMPHALIDÆ*.

Subfamily *EUPLEINÆ*.

Genus **Anosia** Hübner.

1. **Anosia berenice** (Cramer).

*Papilio berenice* CRAMER, Papillons Exotiques, III, 1782, p. 22, Pl. CCV, figs. *E*, *F*.

The collection contains twenty-three males and twenty-three females taken at various places from May 6 until August 30, 1912. Many of the specimens are dwarfed, the smallest male and female having an expanse of only 55 mm. The largest male has an expanse of 65 mm. and the largest female of 78 mm. The dwarfs appear to have been taken at the beginning of the rainy season in May and June and the larger specimens in August. The latter are somewhat brighter in color than the former. In form, markings, and color the specimens do not noticeably differ from individuals coming from other Antillean islands, and from Arizona and Mexico.

Subfamily *HELICONINÆ*.

Genus **Heliconius** Latreille.

2. **Heliconius charithonius** (Linnæus).

*Papilio charithonius* Linnæus, Systema Naturæ, II, 1767, p. 757.

This common and widely distributed neotropical species is represented by forty-one specimens taken at various localities in the island from May 20 to July 31.

They do not differ appreciably from specimens coming from other parts of the Neotropical Region.

## Subfamily NYMPHALINÆ.

Genus *Colænis* Hübner.3. *Colænis julia cillene* (Cramer).

*Papilio cillene* CRAMER, Papillons Exotiques, III, 1782, pp. 38, 174, Pl. CCXV, figs. D, E.

In his paper published in 1907, as Fascicule 63 of Wytzman's "Genera Insectorum," Stichel treats *Colænis delila* Fabricius as a form of *Colænis julia* Fabricius. He gives to the insect figured in "The Butterfly Book," Plate VIII, fig. 4, the varietal name *moderata*. It may be mentioned in passing that the specimen delineated in "The Butterfly Book" was taken in Jamaica and was utilized by the present writer because no specimen of *C. julia* var. *delila* in his possession from either Florida or Texas was sufficiently perfect to admit of reproduction by photography.

The collection made by Mr. Link contains a male and a female taken *in coitu*, June 12, 1912, belonging to the form figured by Cramer as *P. cillene*. The female agrees exactly with the female figured by Stichel ("Genera Insectorum," Fasc. 63, Pl. 2, fig. 1) and the male agrees with the figure of that sex given by Cramer, as cited above. Of this form we have thirty-five males and four females taken on the Isle of Pines at various localities from June 12 to September 3, 1912. It is the prevalent form in the Isle of Pines, and also is at hand from Cuba, and in a modified form from Haiti. The ground-color of the wings is "lustrous golden ochraceous," as stated by Stichel. The Bolivian form, to which Stichel applies the subspecific name *titio*, is characterized by having the wings deep "fiery red" according to that author. The present writer would call them "pale vermilion." We have a good series of specimens of this race taken in the Province del Sara, Bolivia, and some from Colombia.

The form *nudeola* Stichel from Cuba is very like *C. moderata* from Jamaica, and according to the author of the species is simply differentiated from the latter form by having the wings "golden ochraceous." But the wings of *C. moderata* of Jamaica are "golden ochraceous," as the type before me, and a long series of other specimens, show. I am of the opinion that *nudeola* Stichel is a synonym of *moderata* Stichel. The form differs from typical *delila* merely in the

shade of the ground-color; the markings are identical. The various forms may be worked out by means of the following key:<sup>1</sup>

A. Fore wings with heavy dark subapical band.

b. Ground-color of wings dull reddish ochraceous.

*C. julia julia* Fabricius (typical).

(*Habitat* throughout the American tropics.)

bb. Ground-color pale vermillion, size smaller. . . . . *C. julia titio* Stichel.

(*Habitat* from Bolivia to Colombia.)

B. Fore wings with subapical band reduced to a small spot at the end of cell, or entirely absent.

c. Ground-color dull reddish ochraceous. . . *C. julia delila* Fabricius (typical).

(*Habitat* American tropics *passim*.)

cc. Ground-color shining golden ochraceous.

d. Fore wings of males without spots, only the nervules finely scaled with blackish. . . . . *C. julia delila* f. *moderata* = f. *nudeola* Stichel.

(*Habitat* Jamaica, Cuba.)

dd. Fore wing with black spot at end of cell and very narrow black margin on both wings. . . . . *C. julia cillene* Cramer.

(*Habitat* Cuba, Haiti, Isle of Pines, and probably elsewhere in the Antilles.)

#### Genus *Dione* Hübner.

4. *Dione vanillæ* (Linnæus) var. *insularis* Maynard.

*Papilio* (*Nymphalis*) *vanillæ* LINNÆUS, Syst. Nat. (10), 1758, p. 482.

Stichel has attempted to define the races or subspecies of *D. vanillæ* in the "Genera Insectorum," but calls attention to the fact that there does not appear to be any fixity of character in the specimens coming from the various regions where the insect is found. By a process of selection it is possible to discriminate a number of different forms, but it seems to the present writer very doubtful whether they deserve to be regarded as local races, inasmuch as practically the same forms occur everywhere, with but few exceptions.

The insect figured by Clerck in his "Icones," which Stichel regards as typical *D. vanillæ*, is at hand in some numbers from British Guiana, Colombia, Venezuela, Haiti, and Jamaica. But there are also at hand many specimens from the same localities, which do not essentially differ from specimens collected in the Gulf States, Mexico, and the Antilles. We possess one hundred and forty-two specimens taken by Worthington on the various islands of the Bahaman Archipelago,

<sup>1</sup> I cannot regard *C. lucina* Felder as a race of *C. julia* Fabricius, as is done by Stichel. It seems to me to be a valid species, as species go.

which are quite constant, and have a different *facies* from those which come from the northern parts of the South American continent, the black spots being less confluent, those at the end of the cell of the fore wing and near the costa often pupilled with white, and the ground-color somewhat lighter than is the case with the specimens from the mainland. With these specimens for the most part agree the specimens which we possess from Jamaica, Cuba, and the Isle of Pines, as well as many specimens which we have from all over the northern parts of the range of the insect. For this generally prevalent form Stichel suggests the retention of the subspecific name *insularis* proposed by Maynard (*cf.* Maynard, Contributions to Science, Vol. I, 1889, No. 2).

The collection made by Mr. Link contains fifty-five specimens of *D. vanille insularis* taken from May to September, 1912, at various localities throughout the Isle of Pines.

#### Genus **Euptoieta** Doubleday.

##### 5. **Euptoieta hegesia** (Cramer).

*Papilio hegesia* CRAMER, Papillons Exotiques, III, 1782, p. 30, Pl. CCIX, figs. *E, F*.

The specimens are on the average of smaller size than specimens coming from other portions of the range of the insect, and have a decidedly dwarfed appearance. Some of the males have an expanse of wings no greater than 35 mm. The largest female has an expanse of 52 mm.

There are twenty-six specimens, seventeen of which are males, the rest females. They were taken at various localities on the island, and the dates of capture range from May 7 to October 6, 1912.

#### Genus **Eresia** Doubleday.

##### 6. **Eresia frisia** (Poey).

*Melitea frisia* POEY, Centurie de Lépidoptères de L'Ile de Cuba, 1re Décade, April, 1832, Plate.

The collection contains three specimens: a very dwarfed female and a very large female, both taken at Santa Fé, July 19, 1912; and a male of intermediate size taken at Nueva Gerona, August 8, 1912.

The specimens in form and markings do not differ essentially from other examples at hand from Cuba and from the North American mainland.





Genus *Junonia* Hübner.7. *Junonia cœnia* Hübner.

*Junonia cœnia* HÜBNER, Sammlung Exotischer Schmett., Bd. II, 1820-1826, Taf. 245, figs. 1-4.

The collection includes forty-six specimens, male and female, taken from May 6 to July 24, 1912. They are all pale in color and unusually small in size, a number of specimens having an expanse of wing not exceeding 32 mm.

8. *Junonia cœnia genoveva* (Cramer).

*Papilio genoveva* CRAMER, Papillons Exotiques, IV, 1782, p. 4, Pl. CCXC, figs. E, F.

Two specimens of this form are at hand, one taken at Nueva Gerona, September 2, the other at Los Indios, October 6, 1912.

Genus *Anartia* Hübner.9. *Anartia jatrophae* (Linnaeus).

*Papilio jatrophae* LINNÆUS, Mus. Lud. Ulr., 1764, p. 289.

There are seventy-five specimens before me, all taken at Nueva Gerona, except one, which is labeled as from Colombia, July 25, 1912. The dates of capture range from May 7 to August 8, 1912.

10. *Anartia lytrea* (Godart).

*Vanessa lytrea* GODART, Enc. Method., IX, 1819, p. 299.

The collection contains seventy-two specimens of this species, all taken at Nueva Gerona from May 5 to September 30, 1912. The females are lighter in color than the males and have the transverse white bands of the fore and hind wings broader.

Genus *Lucinia* Doubleday & Hewitson.11. *Lucinia cadma* (Drury).

*Papilio cadma* DRURY, Illustrations of Exotic Entomology, II, 1773, Pl. XVIII, figs. 1-2.

There are three specimens, one taken in June, one in July, and one in August, at Nueva Gerona. They are decidedly smaller than specimens at hand from Jamaica, but otherwise not different.

Genus **Timetes** Boisduval.

12. **Timetes eleucha** (Hübner).

*Marpesia eleucha* HÜBNER, Zuträge Exot. Schmett., 1818, Taf. 526, figs. 197-198.

One badly damaged female, Nueva Gerona, August 22, 1912.

The specimen is somewhat larger and darker, more fuscous, than specimens from Jamaica, Cuba, Haiti, Nassau, Mexico, and Florida, which are before me as I write.

Genus **Adelpha** Hübner.

13. **Adelpha iphicla** (Linnæus).

*Papilio iphicla* LINNÆUS, Syst. Naturæ (10), I, p. 780.

Two specimens, both males, one taken July 20, the other August 22, 1912, at Nueva Gerona.

Genus **Aganisthos** Boisduval.

14. **Aganisthos odius** (Fabricius).

*Papilio odius* FABRICIUS, Syst. Ent., 1775, p. 457.

A damaged female taken at Los Indios on November 7, 1912, and a fine specimen of the same sex taken March 22, 1913, at Nueva Gerona.

Genus **Siderone** Hübner.

15. **Siderone ide** Hübner.

*Siderone ide* HÜBNER, Sammlung Exot. Schmett., II, 1820-1826, Pl. 56.

The collection contains three damaged specimens of this variable species, representing the typical form, in which the red band on the upper side of the hind wing is reduced to a small spot on the costa. Two of the specimens were taken at Nueva Gerona, one on May 6, the other on November 10; the third was captured at Columbia, July 29, 1912. The specimen taken on May 6 is not worn, but is as if freshly emerged; the others are tattered.

Genus **Victorina** Blanchard.

16. **Victorina steneles** (Linnæus) var. **insularis**, var. nov.

*Papilio steneles* LINNÆUS, Mus. Lud. Ulr., 1764, p. 218.

Of this common neotropical butterfly there are seventy-seven examples in the collection. They are on the average smaller than specimens which are before me and which come from Mexico, Costa Rica,

Colombia, and elsewhere. The considerable reduction in the size of the pale emerald spots on the wings, with the consequent increase in the breadth of the darker portions of the wings, gives them a quite different *facies* from that presented by specimens coming from the American mainland. A similar reduction of the spots is shown in specimens from Haiti and Porto Rico, before me. I am inclined to regard the form as an insular variety, for which I propose the sub-specific name of *Victorina steneles insularis* var. nov.

Smaller in size than the average of specimens from other parts of the American tropics; darker, because of the restriction in size of the light spots upon the wings; spots in the cell usually not confluent with those on the disk, as is generally the case, and greatly reduced in size, sometimes to mere points.

The specimens were taken at various localities from May to September, but mostly in June and July. Those taken at the later dates appear to be with few exceptions worn females.

Subfamily SATYRINÆ.

Genus **Calisto** Geyer.

17. **Calisto herophile** Hübner.

*Calisto herophile* HÜBNER, in *Zutrage zur Sammlung Exotischer Schmetterlinge*, 1823, figs. 269, 270.

There are nine males and seven females of this little species, which were captured from May to August, mostly at Nueva Gerona. One specimen is labeled as having been taken at Los Indios, and another at a different locality. The specimens taken in May and early June appear to be fresh, as if just from the chrysalis, those captured at later dates are more or less worn.

Family LYCENIDÆ.

Genus **Eumæus** Hübner.

18. **Eumæus atala** (Poey).

*Eumesia atala* (POEY), *Centurie de Lépidoptères de l'Ile de Cuba*, 1re Decade, April, 1832, Plate.

There are seventeen specimens, all taken from May 6 to May 20, at Nueva Gerona, except one specimen, which was taken on May 20 at Los Indios, and a dwarfed male, which was taken at Columbia, August 18, 1912.

Genus **Thecla** Fabricius.19. **Thecla columella** Fabricius.

*Thecla columella* FABRICIUS, Ent. Syst., III, 1, 1793, p. 282.

There is before me a series of thirty-two specimens, male and female, taken from the end of July to the beginning of September at Nueva Gerona.

20. **Thecla martialis** Herrich-Schaeffer.

*Thecla martialis* H.-S., Correspond.-Blatt Regensb., XVIII, 1864, p. 164.

A single somewhat damaged male, taken at Nueva Gerona, May 6, 1912.

21. **Thecla favonius** Smith & Abbot.

*Thecla favonius* SMITH & ABBOT, Rarer Lepidopterous Insects of Georgia, I, 1797, p. 27, Pl. XIV.

A badly torn and rubbed specimen, so poor as to make its identification difficult, yet undoubtedly referable to this species. It was taken at Nueva Gerona, June 8, 1912.

Genus **Lycæna** Fabricius.22. **Lycæna hanno** (Stoll).

*Papilio hanno* Stoll, Suppl. to Cramer's Papillons Exotiques, 1790, p. 170, Pl. XXXIX, figs. 2, 2b.

The collection includes one hundred and one specimens, males and females, all taken at Nueva Gerona, the dates of capture ranging from May 6 to September 6, 1912, though by far the greater number were taken in the month of August.

23. **Lycæna ammon** Lucas.

*Lycæna ammon* LUCAS, in Sagra's Historia de Cuba, VII, 1856, p. 262; Pl. XVI, figs. 6, 7a, 7b.

Mr. Link took eleven specimens, three at Los Indios, the rest at Nueva Gerona. The dates of capture range from May 5 to August 2, 1912.

24. **Lycæna theonus** Lucas.

*Lycæna theonus* LUCAS, in Sagra's Historia Natural de Cuba, VII, 1856, p. 262, Pl. XVI, figs. 8, 8a, 8b.

One rather badly damaged female, taken at Nueva Gerona, August 8, 1912.

## Family PAPILIONIDÆ.

## Subfamily PIERINÆ.

Genus *Tachyris* Wallace.25. *Tachyris ilaire* (Godart).

*Pieris ilaire* GODART, Enc. Meth., IX, 1819, p. 142.

*Mylothris margarita* HÜBNER, Sammlung Exot. Schmett., Vol. II, 1820-1826, Taf. 333.

Godart's specific name has priority over the name *margarita* applied by Hübner.

There are thirteen males and four females in the collection. The males have the dark apical markings reduced to a fine black marginal line. The specimens were taken at Nueva Gerona from the end of June to the latter part of August, 1912.

Genus *Pieris* Schrank.26. *Pieris monuste* (Linnæus).

*Papilio monuste* LINNÆUS, Mus. Lud. Ulr., 1764, p. 237.

Of this common neotropical species the collection contains eleven males and five females. The latter vary greatly in the breadth and intensity of the dark markings of the wings. One female has the wings marked almost exactly as the males. The specimens were all taken at Nueva Gerona, and the dates of capture run from May 9 to August 22, 1912.

Genus *Catopsilia* Hübner.27. *Catopsilia eubule* (Linnæus).

*Papilio eubule* LINNÆUS, Syst. Nat. (10), I, 2, 1767, p. 764.

Of this excessively common insect there is a large series of males and females, taken from May until October, 1912, mostly at Nueva Gerona. The form of the female which has been named *C. sennæ* is as numerous as the less strongly marked female which conforms more nearly to the pattern of maculation found in the males.

It may be remarked at this point that the great variation which occurs in the females both in color and in the maculation of both sides of the wings makes the correct determination of specific relationships and differences in this genus very difficult. Until the test of breeding shall have been thoroughly applied we must remain in some doubt



as to all of the following species. From the large amount of material before me I have been led to conclusions in the case of some of them, which differ somewhat from those expressed by other systematists.

28. **Catopsilia agarithe fornax** Butler.

*Callidryas fornax* BUTLER, Trans. Ent. Soc. [London, 1871, p. 170; Lep. Exotica, 1869-1874, p. 105, Pl. XXXIX, figs. 5, 6 (♀).

The only females which I am able to associate with the male insect, which is plainly referable to *C. agarithe* Boisduval, are four specimens which were taken at dates ranging from May to August, at Nueva Gerona, and which agree on the under side with the male, but are unquestionably the insect described and figured by Butler as *C. fornax*. The suffusion of the wings with crimson on the upper side makes them differ in appearance from females of *C. agarithe* from Florida and elsewhere, but otherwise they agree. I regard them as representing an insular form of *C. agarithe* Boisduval, to which Butler's name may be subspecifically applied. Butler's type of *C. fornax* came from Haiti, and I also have a series of females from that island agreeing with his description and figure.

29. **Catopsilia drya** (Fabricius).

*Papilio drya* FABRICIUS, Syst. Ent., 1775, p. 478 (♀).

*Callidryas godartiana* SWAINSON, Zool. Illustrations, Ser. I, 1820-21, Pl. XXXIV (♀).

*Callidryas orbis* POEY, Centurie de Lépidoptères de l'Ile de Cuba, 1re Decade, 1832 (♂).

There are four males and four females which I refer to this species, the females with a measure of doubt. If they do not hold matrimonial relationships to the insect named *orbis* by Poey, they are divorced from all other insects of the genus before me from the Isle of Pines. The above synonymy expresses the views I at present hold.

30. **Catopsilia neleis** (Boisduval).

*Callidryas neleis* BOISDUVAL, Spécies Générales des Lépidoptères, I, 1836, p. 629, No. 23.

This species and the following are characterized by having the squamation of the outer margins of the wings of the males on the upper side appressed while the scales on the inner two thirds are raised. This gives to the wings the appearance of having been embossed. I have suggested that the trivial name "The Embossed

Sulphur" should be applied to *C. neleis*. The smooth outer surface in *C. neleis* is creamy-white, in *C. editha* Butler it is lemon-yellow, of the same color as the rest of the wing. This difference in color enables the species (or races) to be readily discriminated from each other.

Of *C. neleis* there is a good series of males and females in the collection, all taken at Nueva Gerona from June to August.

31. **Catopsilia editha** (Butler).

*Callidryas editha* BUTLER, Trans. Ent. Soc. London, 1870, p. 10, No. 4; Lepidoptera Exotica, 1869-1874, p. 105, Pl. XXXIX, figs. 1-4.

A series of males and females of this form, the differences between which and *C. neleis* Boisd. have just been pointed out, are at hand. They were taken at Nueva Gerona from May to August.

Genus **Terias** Swainson.

32. **Terias nicippe** (Cramer).

*Papilio nicippe* CRAMER, Papillons Exotiques, III, 1782, p. 31, Pl. CCX, figs. C, D.

There are over thirty specimens, males and females, taken at Nueva Gerona from the beginning of May until the middle of August.

33. **Terias citrina** Poey.

*Terias citrina* POEY, Memorias sobre la Historia Natural de Cuba, I, 1853, p. 247, Pl. 18, figs. 4-7.

I recognize a male specimen taken at Nueva Gerona, May 22, as belonging to this species. There is an albino female taken on June 12, which I think may belong with it, but am in doubt. It has the large ferruginous spot at the outer angle of the secondaries on the under side, which is one of the diacritical marks of the species.

34. **Terias dina** Poey.

*Terias dina* POEY, Centurie des Lépidoptères de l'Ile de Cuba, 2me Decade, 1832, Plate.

Three examples taken at Nueva Gerona, May 14-16, 1912, may be referred to this species. They agree with specimens from Cuba purchased by the writer a number of years ago from the late Dr. O. Staudinger, and accord fully with the description and figures given by Poey.

35. *Terias euterpe* Ménétriés.

*Terias euterpe* MÉNÉTRIÉS, Nouv. Mem. Soc. Imp. des Naturalistes de Moscou, III, 1834, p. 121, Pl. XI, fig. 4.

I cannot find any great difference between this insect and *T. lisa* Boisduval & Leconte, except that it is a little smaller in size than the average of specimens of *T. lisa* from the American mainland, and the black borders of the wings are a trifle heavier. But similar specimens can be culled out of collections of *T. lisa* from Florida and the Carolinas. If *T. lisa* is not to be sunk as a synonym of *T. euterpe*, as has been done by some recent authors, the arrangement should be as follows:

*Terias euterpe euterpe* Ménétriés, *habitat* Cuba and Isle of Pines.

*Terias euterpe lisa* Boisduval & Leconte, *habitat* American mainland.

There are sixteen males and five females referable to this form, all of which were taken at Nueva Gerona in July and August.

36. *Terias elathea* (Cramer).

*Papilio elathea* CRAMER, Papillons Exotiques, II, 1779, p. 5, Pl. XCIX, figs. C, D.

There are seventeen males taken at Nueva Gerona and one male taken at Santa Fé. The dates of capture range from the middle of July to the beginning of August. The specimens average a little smaller in size than the majority of those coming from other localities in the collection of the writer, or contained in the Carnegie Museum. Unfortunately Mr. Link failed to secure a single female, which seems singular.

37. *Terias lucina* Poey.

*Terias lucina* POEY, Memorias sobre la Historia Natural de Cuba, I, 1853, p. 252, Pl. 18, figs. 8-10.

Of this species there are forty-five males and twenty-seven females taken at various localities, most of them at Nueva Gerona, from May until August.

38. *Terias amelia* Poey.

*Terias amelia* POEY, l. c., p. 253, Pl. 18, figs. 11-13.

This species is represented by thirty specimens, mostly males, taken at Nueva Gerona and Los Indios from the beginning of May until the first week in August.

## Subfamily PAPILIONINÆ.

Genus **Papilio** Linnæus.39. **Papilio andræmon** Hübner.

*Papilio andræmon* HÜBNER, Sammlung Exot. Schmett., II, 1823, Plates 311, 312.

There is a series of twenty-five specimens of this species at hand, all taken at Nueva Gerona from June 6 to September 2, 1912. Very few of the specimens are in absolutely perfect condition. The females are on the average larger and darker than the males.

40. **Papilio celadon** Lucas.

*Papilio celadon* LUCAS, Révue Zoologique, 1852, p. 130.

There are thirteen mostly somewhat damaged specimens of this species in the collection, which were taken at Caleta Grande and Nueva Gerona from April 16 to August 30.

It is remarkable that Mr. Link only succeeded in obtaining specimens of two species of *Papilio* during his visits to the island. The absence from the collection of some very common and widely distributed species, such as *P. polydamas*, which we have from almost all the Antillean islands, is singular. Whether the failure to get these species was due to the somewhat desultory collecting done by Mr. Link, or whether they do not occur upon the island, it is impossible for the writer to say.

## Family HESPERIIDÆ.

## Subfamily HESPERIINÆ.

Genus **Eudamus** Swainson.41. **Eudamus proteus** (Linnæus).

*Papilio proteus* LINNÆUS, Mus. Lud. Ulr., 1764, p. 333.

The collection contains one hundred and twenty-six specimens of this common species, all representing the form in which the internal dark band upon the lower side of the secondaries is broken into two spots near the costa. They were all taken at Nueva Gerona, and the dates of capture range from May 6 to the end of August.

42. **Eudamus santiago** Lucas. (Plate XXXI, fig. 6.)

*Eudamus santiago* (LEFEBVRE MS.) LUCAS, in Sagra's Historia Natural de Cuba, VII, 1857, p. 267.

Godman in the *Biologia Centrali-Americana*, *Rhopalocera*, Vol. II,

p. 279, states that this species replaces in the Antilles, and is but "slightly different" from, *Eudamus dorantes* Stoll. Through the great kindness of Mr. Godman the Carnegie Museum possesses a considerable number of species of neotropical Hesperiidæ from his collection, presented to this museum about the time when Mr. Godman was transferring the main collection as a gift to the British Museum. Among the specimens given to the Carnegie Museum is a series of four labeled "*E. santiago*." Two of these are from St. Vincent, and one from Grenada, all taken by H. H. Smith. They are quite like *E. dorantes*. The fourth specimen is labeled "Cuba," and agrees precisely with the long suite of specimens before me from the Isle of Pines. But this Cuban specimen derived from Mr. Godman and all of the specimens in the collection upon which I am now reporting are strikingly different from the St. Vincent and Granada insects, and from examples of *E. dorantes* from the American mainland. They are much darker on the under side, the spots are confluent, and the bands which they form arrange themselves as clouded markings on the outer third of the secondaries somewhat as is the case in *E. undulatus* Hewitson, which they seem to recall more than they do *E. dorantes*.

There are eighty-nine specimens in the collection, males and females, which were without exception taken at Nueva Gerona. The dates of capture range from May 6 until the end of August.

#### Genus *Phocides* Hübner.

##### 43. *Phocides batabano* (Lucas).

*Eudamus batabano* (LEFEBVRE MS.) LUCAS, in Sagra's Hist. Natural de Cuba, VII, 1856, p. 268.

Represented by three specimens taken at Nueva Gerona, from July 29 to August 28.

#### Genus *Epargyreus* Hübner.

##### 44. *Epargyreus maysi* (Lucas). (Plate XXXI, figs. 11, 12.)

*Eudamus maysi* (LEFEBVRE MS.) LUCAS, in Sagra, *l. c.*, p. 269.

The insect, which I positively identify as *E. maysi* Lucas, is represented in the collection by a series of twenty-four specimens, males and females. On the upper side there is a striking resemblance to *Proteides idas* var. *san antonio* (Lucas), but the under side is wholly different, as shown in the figures on Plate XXXI. On this side the



insect more nearly resembles *Epargyreus exadeus* Cramer, of which it may be regarded as an extreme insular variety, though so far removed from the parent stock as to merit recognition as a species.

The specimens were all taken at Nueva Gerona, and the dates of capture range from the end of July to the beginning of September.

45. **Epargyreus asander** Hewitson.

*Eudamus asander* HEWITSON, Descript. Hesperid., p. 9; Exotic Butterflies, Eudamus, Pl. III, fig. 24.

There are two specimens of this species taken at Nueva Gerona on July 30 and August 10.

Genus **Proteides** Hübner.

46. **Proteides idas** (Cramer) var. **san antonio** (Lucas). (Plate XXI, figs. 1, 2.)

*Papilio idas* CRAMER, Papillons Exotiques, III, 1782, p. 113, Pl. CCLX, figs. A, B. *Eudamus san antonio* (LEFEBVRE MS.) LUCAS, in Sagra's Historia Natural de Cuba, VII, 1856, p. 269.

In this insular form of *P. idas* the transparent spots of the wings have become almost entirely obliterated or reduced to microscopic points, except the minute spots on the costa of the primaries. Only one of the great suite of specimens before me retains the spots on the disk of the fore wings though somewhat reduced and thus corresponds with the form described as *P. angasi* by Godman, a specimen of which from St. Vincent donated by Mr. Godman to the Carnegie Museum is before me as I write. The Cuban form, like *P. angasi* Godman, has the white markings of the under side of the secondaries greatly obscured and more or less suffused with "chocolate red," as pointed out by Godman.

Mr. Link took eighty-one specimens of this insect at Nueva Gerona from the last week in July to the last week in August.

Genus **Nennius**<sup>1</sup> Kirby.

(*Acolastus* Scudder.)

47. **Nennius amyntas** (Latreille).

*Papilio amyntas* FABRICIUS, Syst. Ent., 1775, p. 533.

*Hesperia savignyi* LATREILLE, Enc. Méth., IX, 1823, p. 741.

This widely distributed insect is represented in the collection by seventeen specimens, male and female, a few taken in May, and the rest from the last of July to the end of August. They belong,

<sup>1</sup> Cf. New Ed. *Hübner's Sammlung*, Edit. Kirby, Vol. III, p. 105.

as do almost all of the specimens we have from the Antilles, to the form in which the prevalent color of the under side of the wings is purple instead of brownish as is the case in most, but not all, specimens from the North and South American mainland.

Genus **Telegonus** Hübner.

48. **Telegonus habana** (Lucas).

*Eudamus habana* (LEFEBVRE MS.) LUCAS, in Sagra's *Historia Natural de Cuba*, VII, 1856, p. 268.

Of this species the collection contains fourteen specimens, several taken at Nueva Gerona at the end of March, the others taken at the same place from the end of July to the end of August. This fact suggests that the species may be double-brooded.

49. **Telegonus geronæ** sp. nov.

In outline and color nearly related to *T. hahneli* Staudinger, but differing in having the collar, patagia, and thorax iridescent greenish blue. In *T. hahneli* (*vera*) the collar and thorax are dark brown or black, without a trace of blue or green. I have a set of four specimens of *T. hahneli* purchased from Dr. Staudinger. The first pair is labeled *T. cassander* Fabricius, under which name Staudinger first marketed the species, and figured it in his *Exotische Schmetterlinge*, Plate 98. The second pair is labeled *Æthilla hahneli*, under which name he described the insect in the text of the *Exotische Schmetterlinge*, Theil I, p. 291, having discovered that the insect figured on his plate is not the species named *cassander* by Fabricius. I also have a specimen before me derived from the Godman Collection and now belonging to the Carnegie Museum, which bears Mr. Godman's label *T. hahneli*. These five specimens agree absolutely among themselves in showing not the least trace of the blue-green squamation of the collar and thorax, which is conspicuous in *T. geronæ*. The hind wings of *T. geronæ*, especially the secondaries, are very dark on the under side, and are lightly sprinkled with bronzy scales. There is scarcely any trace of the dark transverse bands on the lighter ground of the under side of the primaries which are well-marked features in *T. hahneli*.

*T. geronæ* has undoubtedly been confounded in collections with *T. hahneli*. We have a specimen from Costa Rica labeled "*T. hahneli* Stgr." by Schaus, which clearly belongs to the new species. Staud-

inger's statement that *T. hahneli* occurs in Cuba is no doubt due to the fact that he was misled by the strong superficial resemblance between the two insects under consideration, and so also is the phrase in Godman's brief Latin diagnosis "*capite et prothorace viridi lavatis*," although the specimen labeled by him does not show the slightest trace of this feature. With the description of *T. vespasius* Fabricius, under which Kirby has put *T. cassander*, this insect does not agree, nor is it *cassander*, as has been pointed out.

I should have been glad to avoid the creation of a new name in this genus, and have vainly endeavored to assign the insect under consideration to one of the species described from Cuba by Lucas, by Herrich-Schaeffer, and older authors, but have failed. None of their descriptions seem to apply to it.

#### Genus *Melanthes* Mabille.

50. *Melanthes otreus* (Cramer) var. *brunnea* (Herrich-Schaeffer).  
(Plate XXXI, figs. 3-5.)

*Papilio otreus* CRAMER, Papillons Exotiques, IV, 1782, p. 78, Pl. 328, fig. F.

*Oileides zephodes* HÜBNER, Samml. Exot. Schmett., II, 1820-1824, Pl. 364, figs.

1-4 (♀).

Cf. *Nisoniades brunnea* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XVIII, 1864, p. 172 (♂).

Cf. *Achlyodes jamaicensis* MÖSCHLER, Verhandl. Zoöl. Gesellsch. Wien, 1878, p. 226.

The insect figured by Hübner as *Oileides zephodes* has been consistently identified by older and many later authors, among these Herrich-Schaeffer and Mabille, with the species named *Papilio otreus* by Cramer (*vide supra*). Cramer gives Surinam as the habitat of the species. I have not seen a specimen from that country, but it may be found there. The figure given by Cramer is exceedingly poor, and it requires a stretch of the imagination to make it out to be the same insect as that figured by Hübner, whose illustrations likewise are in this case none of the best. The figures of *Oileides zephodes* given by Hübner, while intended to represent the male and the female insect, were drawn from two females, as we are informed by Herrich-Schaeffer, who at the time he wrote his description of *Nisoniades brunnea* had the insects used by Hübner in his possession. Herrich-Schaeffer among other things states that he has in his possession a female sent to him from Cuba by Dr. Gundlach, which is not specifically distinguishable from *otreus*. Mabille erected his genus *Melanthes*

for the reception of Herrich-Schaeffer's *N. brunnea*, because among other things the male has a costal fold on the primaries, while he retains the genus *Ephyriades* Hübner as having no costal fold. He includes in the genus *Melanthes* the species named *jamaicensis* by Möschler, but calls attention to the fact that the only difference he can discover between *brunnea* H.-S. and *jamaicensis* Möschler is the slightly larger size and the larger size of the vitreous spots in the fore wings of the latter.

The fact of the matter is that we are dealing in this instance with a widely distributed species, in which a number of local races may be recognized. With the material before me from Jamaica, Cuba, Haiti, Porto Rico, the Bahamas, and after a careful inspection of the material preserved at the National Museum in Washington, the American Museum of Natural History in New York, and in the Academy of Natural Sciences in Philadelphia, I have reached the conclusion that it is quite proper in the first place to accept the genus *Melanthes* of Mabille, and to sink the nondescript genus *Ephyriades* of Hübner, at least insofar as it has been used by Mabille as a receptacle for the species named *otreus* by Cramer and *zephodes* by Hübner, the male of which has a large costal fold. If a Hübnerian generic name is to be used that of *Oileides* given by Hübner himself should have the preference. In the second place it is obvious to me that *zephodes* Hübner is the female of the insect to a varietal form of the male of which Herrich-Schaeffer applied the specific name *brunnea*, and to another varietal form of the male of which Möschler gave the specific name *jamaicensis*.

In eastern Cuba, Jamaica, and Haiti the form with large spots on the wings of the females is common. This form may be designated as *M. otreus otreus* (Cramer) = *zephodes* Hübner. In western Cuba and the Isle of Pines the prevalent form is one in which the spots both in the wings of the males and the females are greatly reduced in size, showing a tendency to become obsolete. This form may be designated as *M. otreus brunnea* (Herrich-Schaeffer). The form which is most prevalent in Jamaica and in the Bahamas is intermediate between these two, and may be called *M. otreus jamaicensis* (Möschler). It is not to be accepted, however, as established, that there is no variation in a given locality. Between these forms there are such as intergrade. On Plate XXXI, figs. 4 and 5, I give the male and the female of the insect as it occurs on the Isle of Pines, and also in figure 3 a

representation of the female of *otreus* = *zephodes* from the eastern end of Cuba, which was taken by Kaden, and by us received from Mr. Godman. It is quite like females I have from Haiti, and represents the true *M. otreus*.

The collection from the Isle of Pines contains nine males and twelve females taken at Nueva Gerona, the dates of capture ranging from May 6 to August 28, 1912. They are all characterized by the great reduction of the vitreous spots in the primaries.

#### Genus **Brachycorene** Mabille.

##### 51. **Brachycorene arcas** (Drury).

*Papilio arcas* DRURY, Illustrations of Exotic Entomology, I, 1773, Pl. XIX, figs. 5, 6.

(?) *Papilio flyas* CRAMER, Papillons Exotiques, IV, 1782, p. 78, Pl. 328, fig. E.

*Thanaos velasquez* (LEFEBVRE MS.) Lucas, in Sagra's Hist. Nat. de Cuba, VII, 1856, p. 273.

*Achlyodes arcas* KIRBY, Syn. Cat. Diurn. Lep., 1871, p. 632.

*Brachycorene arcas* MABILLE, Genera Insectorum, Hesperidæ, 1904, p. 81.

Mr. Link took two male specimens at Nueva Gerona, one on July 22, the other on July 31, 1912.

#### Subfamily PAMPHILINÆ.

#### Genus **Hesperia** Fabricius.

##### 52. **Hesperia syrictus** (Fabricius).

*Papilio syrictus* FABRICIUS, Syst. Ent., 1775, p. 534.

The collection includes thirty-seven specimens of this common neotropical skipper, of which nine are females. They were all taken at Nueva Gerona from the beginning of June to near the end of August, 1912.

#### Genus **Ancyloxypha** Felder.

##### 53. **Ancyloxypha** (?) **nanus** (Herrich-Schaeffer).

*Thymelicus nanus* HERRICH-SCHAEFFER, Corr. Blatt. Regensb., XIX, 1865, p. 52.

This insect is referred by Mabille with doubt to the genus *Copæodes* to which it certainly does not belong, as has been pointed out by Godman in the *Biologia* (*Rhopalocera*, Vol. II, p. 473). I assign it provisionally to the genus *Ancyloxypha*, to which it comes much nearer than it does to *Copæodes*, and to which it may indeed belong, though I cannot be sure until a dissection has been made.



We have one male, taken May 7, and a female taken August 7, both at Nueva Gerona.

Genus **Hylephila** Billberg.

54. **Hylephila phylæus** (Drury).

*Papilio phylæus* DRURY, Ill. Exot. Ent., I, 1773, p. 25, Pl. XIII, figs. 4, 5.

Of this commonest of all neotropical Pamphilids there are in the collection seventy-six males and twenty-one females, all taken at Nueva Gerona at the end of August and during the first week of September.

Genus **Atalopedes** Scudder.

55. **Atalopedes cunaxa** (Hewitson). (Plate XXXI, fig. 14, ♀, *underside*).

*Hesperia cunaxa* HEWITSON, Trans. Ent. Soc. London, (3), Vol. II, 1866, p. 488; Exotic Butterflies, Vol. IV, Hesperidæ, Pl. IV, figs. 38, 39.

*Hesperia mesogramma* POEY, (*nec* Latreille) Centurie de Lépidoptères de l'Île de Cuba, 1833, Plate.

Of this species there are eight males and eight females, taken from the end of July to September 10, 1912.

Genus **Catia** Godman.

56. **Catia misera** (Lucas).

*Hesperia misera* (LEFEBVRE MS.) LUCAS, in Sagra's Hist. Nat. de Cuba, VII, 1856, p. 279.

*Pamphila mago* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XVII, 1863, p. 143.

A considerable series of this species, which is congeneric with *atna* and *egeremet* of Scudder, was taken at various places on the island, principally at Nueva Gerona. Mr. J. L. Graf collected a number in May, 1910, and Mr. Link a long series from June to November.

Genus **Limochores** Scudder.

57. **Limochores baracoa** (Lucas). (Plate XXXI, fig. 15, ♂.)

*Hesperia baracoa* (LEFEBVRE MS.) LUCAS, in Sagra's Hist. Nat. de Cuba, VII, 1856, p. 279.

*Pamphila amadis* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XVII, 1863, p. 142.

*Pamphila myus* FRENCH, Canadian Entomologist, XIII, 1884, p. 33; Butterflies of the Eastern United States, 1885, p. 321.

There is a long suite of this species, composed of specimens taken in May, 1910, by Mr. J. L. Graf, and of others taken by Mr. Link

at the end of August and the beginning of September. They come from Nueva Gerona and Los Indios.

Genus **Lerodea** Scudder.

58. **Lerodea eufala** (W. H. Edwards).

*Hesperia eufala* W. H. EDWARDS, Trans. Am. Ent. Soc., II, 1869, p. 311.

There are two specimens agreeing with the types. They were taken at Nueva Gerona, one on August 8, the other on September 6, 1912.

59. **Lerodea tripuncta** (Herrich-Schaeffer).

*Cobalus tripunctus* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XIX, 1865, p. 53.

The collection includes nine specimens of this obscure little butterfly taken at the end of July and the beginning of August at Nueva Gerona.

Genus **Amblyscirtes** Scudder.

60. **Amblyscirtes insulæ-pinorum** sp. nov. (Plate XXXI, figs. 7, ♂, 8, ♀.)

Allied to *Amblyscirtes folia* Godman, which apparently is identical with the insect recently named *Amblyscirtes tutolia* by Dyar (Proc. U. S. N. M., XLIV, p. 281). The species differs from *A. folia* in having the fringes of both the fore and hind wings dark fuscous, and not white as in that species; in the entire absence of the white spot near the end of the cell on the under side of the secondaries; and the restriction of the series of submarginal spots, which in *A. folia* form an almost circular band of white dots around the wing, to at most four small white points opposite the end of the cell on the lower side of the secondaries. On the upper side of the fore wing the male has two small yellowish subapical spots, and a similar minute spot between the second and the third median nervules near their origin, and distal to the heavy black sexual brand, which latter is conspicuous. The female has four spots on the disk increasing in size toward the posterior margin. Both the sexes have the hind wings entirely immaculate upon the upper side. Expanse, ♂, 50 mm.; ♀, 55 mm.

On plate XXXI figs. 7 and 8, I show the under side of the wings of the types of the male and female.

There are five specimens of the species in the collection, four females and one male. All were taken at Nueva Gerona. Three of

the females were taken by Mr. Graf in May, 1910; the male (type) was taken by Mr. Link on July 19, 1912, and the female type on June 10, 1912, by the same gentleman.

Genus **Prenes** Scudder.

61. **Prenes nero** (Fabricius).

*Hesperia nero* FABRICIUS, Ent. Syst., V, 1798, p. 433.

Of this well-known species the collection contains two specimens, a male and a female taken in the first week of August at Nueva Gerona.

62. **Prenes corrupta** (Herrich-Schaeffer). (Plate XXXI, fig. 13, underside.)

*Goniloba corrupta* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XIX, 1865, p. 54.

Mr. Link took ten specimens of this species at Nueva Gerona from August 4 to September 10, 1912. They represent both sexes.

Mr. Godman in the *Biologia Centrali-Americana* sinks this form in the synonymy of *P. nero* Fabricius, but it is constant, and occurring at the same place and time with *P. nero*, it seems to me to be entitled to specific rank, until such time at least as the test of breeding shall have been applied, and its specific identity with *P. nero* shall have been established upon stronger grounds than a mere general resemblance.

63. **Prenes ocola** (W. H. Edwards).

*Hesperia ocola* W. H. EDWARDS, Proc. Ent. Soc. Philada., II, 1863, p. 20, Pl. XI, fig. 4.

Four specimens taken at Nueva Gerona, the dates of capture running from August 2 to September 9. They do not differ from specimens taken in Florida.

Genus **Asbolis** Mabille.

64. **Asbolis sandarac** (Herrich-Schaeffer). (Plate XXXI, fig. 9, ♀.)

*Goniloba sandarac* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XIX, 1865, p. 54.

There are two females and a male in the collection taken at Nueva Gerona, the females by Mr. J. L. Graf on May 10 and 11, 1910, and the male by Mr. Link on July 22, 1912.

Genus **Phemiades** Hübner.

65. **Phemiades antiqua** (Herrich-Schaeffer). (Plate XXXI, fig. 10, ♂.)

*Pamphila antiqua* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XVII, 1863, p. 142.

*Hesperia utha* HEWITSON, Descript. Hesp., 1868, p. 37.

There are six specimens of this fine species in the collection, males and females, taken at Nueva Gerona in the months of July and August. The Jamaican form has been named *P. jamaicensis* by Schaus. For the form which occurs in Haiti, and which is in some respects intermediate between the Cuban and Jamaican forms, I propose the varietal name *haitensis*.

Suborder *HETEROCERA*.

Superfamily *SPHINGOIDEA*.

Family *SPHINGIDÆ*.

Genus *Herse* Oken.

66. *Herse cingulata* (Fabricius).

*Sphinx cingulata* FABRICIUS, Syst. Ent., 1775, p. 545, No. 29.

Two specimens, both taken at Columbia, September, 1912.

Genus *Cocytius* Hübner.

67. *Cocytius antæus medor* (Stoll).

*Sphinx medor* STOLL, in Cramer's Papillons Exotiques, IV, 1782, p. 215, Pl. CCCXCIV, fig. A.

One male taken at Nueva Gerona in August.

Genus *Protoparce* Hübner.

68. *Protoparce sexta* (Johansson).

*Sphinx sexta* JOHANSSON, Amœnitat. Academ., VI, 1763, p. 410, No. 81.

Two females, one taken at Nueva Gerona on September 4, the other taken at the same place, September 12, 1912.

69. *Protoparce rustica* (Fabricius).

*Sphinx rustica* FABRICIUS, Syst. Ent., 1775, p. 540, No. 15.

One male specimen captured at Columbia, in the month of August.

Genus *Protambulyx* Rothschild & Jordan.

70. *Protambulyx strigilis carteri* Rothschild & Jordan.

*Protambulyx carteri* ROTHSCHILD & JORDAN, Novitates Zoölog., IX, Suppl., 1903, p. 180, Pl. LXVI, fig. 3, Pl. LXVII, fig. 12.

A single female taken at Nueva Gerona, August 13, 1912.

Genus **Erinnyis** Hübner.

71. **Erinnyis alope** (Drury).

*Sphinx alope* DRURY, Illustr. Exotic Entomol., I, 1773, p. 58, Pl. XXVII, fig. 1.

A female taken at Nueva Gerona, February 22, 1913.

Genus **Pachylia** Walker.

72. **Pachylia ficus** (Linnæus).

*Sphinx ficus* LINNÆUS, Syst. Nat., (10) 1758, p. 491, No. 13.

A female captured at Nueva Gerona, March 12, 1913.

Genus **Epistor** Boisduval.

73. **Epistor lugubris** (Linnæus).

*Sphinx lugubris* LINNÆUS, Mant. Plant., 1771, p. 537.

One female taken at Columbia. No date given.

Genus **Sesia** Fabricius.

74. **Sesia fadus** (Cramer).

*Sphinx fadus* CRAMER, Papillons Exotiques, I, 1775, p. 95, Pl. LXI, fig. C.

One male and five females, all taken at Nueva Gerona, and all on August 10, except one female, which was taken on August 12.

Genus **Pholus** Hübner.

75. **Pholus labruscæ** (Linnæus).

*Sphinx labruscæ* LINNÆUS, Syst. Nat. (10), 1758, p. 491, No. 12.

Two specimens taken at Columbia, August 13, ♂, and August 24, ♀.

Genus **Xylophanes** Hübner.

76. **Xylophanes tersa** (Linnæus).

*Sphinx tersa* LINNÆUS, Mant. Plant., 1771, p. 538.

The collection contains a male and a female taken at Columbia near the end of August, 1912, and a male captured at Nueva Gerona, February 22, 1913. This would indicate that there are two, if not more, annual broods of this species.

77. **Xylophanes robinsoni** (Grote).

*Charocampa robinsoni* GROTE, Proc. Ent. Soc. Philada., V, 1865, p. 54, Pl. I, fig. 2.

There are two males, both taken at Nueva Gerona, the one captured June 6, 1912, is bright and fresh, the other taken on August 13 is much worn and faded.



## Family AMATIDÆ Hampson.

(Syntomidæ, *auctorum*.)Genus **Eunomia** Hübner.78. **Eunomia latenigra** (Butler).*Marissa latenigra* BUTLER, Journ. Linn. Soc. London, XII, 1876, p. 395.*Eunomia latenigra* HAMPSON, Cat. Lep. Phalænæ, I, 1898, p. 200.

One male specimen taken at Los Indios, November, 1912.

Genus **Nyridela** Lucas.79. **Nyridela xanthocera** (Walker).*Gymnelia xanthocera* WALKER, List. Lep. Heterocera in Brit. Mus., VII, 1856, p. 1603.*Nyridela xanthocera* HAMPSON, Cat. Lep. Phalænæ, I, 1898, p. 218.

One male specimen taken at Nueva Gerona, March 22, 1912. The antennæ are yellow throughout, and the specimen agrees perfectly with the long series of this insect, which we have in the Carnegie Museum from different parts of Central America and Jamaica.

Genus **Napata** Walker.80. **Napata chalybea** (Hübner).*Uranophora chalybea* HÜBNER, Zutræge Exot. Schmett., III, 1827, p. 14, figs. 439, 440.*Napata chalybea* HAMPSON, Cat. Lep. Phalænæ, I, 1898, p. 409.*Ctenucha hilliana* DYAR, Insecutor Inscitiæ Menstruus, III, 1915, p. 62.

Five specimens, males and females, taken at Nueva Gerona, the dates of capture ranging from June 8 to September 3.

I have seen the type of *Ctenucha hilliana* Dyar, and find it to be identical with *N. chalybea*.

## Family ARCTIADÆ.

Genus **Utetheisa** Hübner.81. **Utetheisa venusta** (Dalman).*Euprepia venusta* DALMAN, Anal. Ent., 1823, p. 51.

There are three specimens of this common insect taken at Los Indios in November.

Family NOCTUIDÆ.

Genus **Xanthopastis** Hübner.

82. **Xanthopastis timais** (Cramer).

*Phalena timais* CRAMER, Papillons Exotiques, III, 1782, p. 148, Pl. CCLXXV, fig. B.

Three specimens taken at Nueva Gerona from the end of June to the first week in August.

Genus **Cydosia** Westwood.

83. **Cydosia linki** sp. nov. (Plate XXXI, fig. 16.)

Nearest *C. phædra* Druce, but to be distinguished at a glance by the fact that it has but two cupreous bands crossing the fore wing, while *C. phædra* has three such bands.

Black, shot with deep blue; vertex white; patagia with two small white spots; thorax and abdomen blue-black throughout; fore wing with three minute white spots, one immediately at the base, closely followed by two others, the upper one being a trifle larger than the lower. These are next succeeded by a cupreous band, which originates at the base, is carried outward along the costa for a short distance, and then at right angles descends to the inner margin, gradually increasing in width. This band is followed distally by two rows of subcircular white spots, the upper two located upon the cell being the larger. These spots are succeeded by the second cupreous band, which is broader than the first, and runs from the costa to the inner margin, at right angles to it. The second band is succeeded externally by four small white spots, two near the apex and two near the inner angle, the first and the fourth in the series being smaller than the pair in the middle, between which there is an interval greater than that between the two upper and the two lower spots of the series. Expanse 24 mm.

The type is unique, and was taken at Los Indios in November, 1912, by Mr. G. A. Link, Sr., in recognition of whom I name the species.

Genus **Heliocontia** Hampson.

84. **Heliocontia pantherula** (Herrich-Schaeffer).

*Emmelia pantherula* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XXII, 1868, p. 151.

One male specimen taken at Los Indios, November, 1912.

Genus **Mocis** Hübner.85. **Mocis disseverans** (Walker).

*Remigia disseverans* WALKER, List. Lep. Het. B. M., XIV, 1858, p. 1495.

A male taken at Columbia, August 25, and a female captured at Nueva Gerona, March 13, are the only representatives of this common insect.

Genus **Latebraria** Guenée.86. **Latebraria amphipyroides** Guenée.

*Latebraria amphipyroides* GUENÉE, Spec. Gén., VII, p. 159.

One ragged specimen taken on Keenan Mt., August 28, 1912.

Genus **Hemeroblemma** Hübner.87. **Hemeroblemma pandrosa** (Guenée).

*Peosina pandrosa* GUENÉE, Spec. Gén., VII, 1852, p. 134.

A male and a female both taken at Nueva Gerona, the male in March, the female in September.

Genus **Macrodes** Guenée.88. **Macrodes cynara** (Cramer).

*Phalæna Geometra cynara* CRAMER, Papillons Exotiques, I, 1774, p. 23, Pl. XV, figs. C, D.

A single female taken at Nueva Gerona, August 28.

Genus **Hypena** Schrank.89. **Hypena** sp?

A single specimen too poor for identification.

## Family PERICOPIDÆ.

Genus **Composia** Hübner.90. **Composia fidelissima** Herrich-Schaeffer.

*Composia fidelissima* HERRICH-SCHAEFFER, Corr.-Blatt Regensb., XX, 1866, p. 131.

A fine series of this showy moth taken from July 29 to August 12, at Nueva Gerona.

## Family DIOPTIDÆ.

Genus **Lauron** Walker.91. **Lauron ergolis** (Walker).

*Dioptis ergolis* WALKER, List Lep. Het. B. M., II, 1854, p. 335.

A male captured June 2, and a female taken August 12, 1912, both at Nueva Gerona.

Family NOTODONTIDÆ.

Genus **Noropsis** Guenée.

92. **Noropsis hieroglyphica** (Cramer).

*Noctua hieroglyphica* CRAMER, Papillons Exotiques, II, 1779, p. 81, Pl. CXLVII, fig. D.

A pair taken *in coitu* at Los Indios, November, 1912.

Family GEOMETRIDÆ.

Genus **Melanchroia** Hübner.

93. **Melanchroia geometroides** Walker.

*Melanchroia geometroides* WALKER, List Lep. Het. B. M., II, 1854, p. 387.

*Glaucopsis* (?) *mors* (LEFEBVRE MS.) LUCAS, in Sagra's Hist. Nat. de Cuba, VII, 1856, p. 285.

There is a good series of this species. The specimens were taken by Messrs. Graf and Link in May, 1910, at several localities; and in August, 1912, by Link at Nueva Gerona.

Walker gives Java as the habitat of his *M. geometroides*. I follow the precedent of those who regard the locality given by Walker as the result of an error in labeling.

Genus **Eupithecia** Curtis.

94. **Eupithecia** sp?

A single specimen badly rubbed, and too poor for identification.

Genus ?

95. **Geometer**, Gen. (?) sp. (?).

A minute species, badly preserved, and impossible to identify without more and better material.

Family URANIIDÆ.

Genus **Urania** Fabricius.

96. **Urania boisduvali** Guerin.

*Urania boisduvali* GUERIN, Icones Regne Anim., Ins., 1829-1844, p. 490, Pl. 82, fig. 1.

The collection contains a small series of this beautiful insect, males and females; one male taken in July, the others in September, and all at Nueva Gerona.

## Family PYRALIDÆ.

Genus *Syngamia* Guenée.97. *Syngamia florella* (Cramer).

*Phalæna pyralis florella* CRAMER, Papillons Exotiques, IV, 1782, p. 114, Pl. CCCXLVII, fig. L.

Five specimens taken at Nueva Gerona at the end of August and beginning of September.

Genus *Conchylodes* Guenée.98. *Conchylodes diphtheralis* (Geyer).

*Lipotigris diphtheralis* GEYER, Zuträge Hübner's Exot. Schmett., IV, 1818-1837, Pl. 610 (115), figs. 691, 692.

A single specimen taken at Nueva Gerona, June 10, 1912.

Genus *Sylepta* Hübner.99. *Sylepta reginalis* (Cramer).

*Phalæna Pyralis reginalis* CRAMER, Papillons Exotiques, IV, 1782, p. 163, Pl. CCCLXXII, fig. C.

One specimen captured at Columbia, July 25.

Genus *Glyphodes* Guenée.100. *Glyphodes hyalinata* (Linnæus).

*Phalæna Geometra hyalinata* LINNÆUS, Syst. Nat. (Ed. 12), Vol. I, 1767, p. 874.

Three specimens, one taken in May by Graf, and the rest by Link in September, all at Nueva Gerona.

Genus *Leucinodes* Guenée.101. *Leucinodes elegantalis* Guenée.

*Leucinodes elegantalis* GUENÉE, Spec. Gén., Vol. VIII, 1854, p. 222, Pl. III, fig. 8.

A single specimen captured at Los Indios in November.

Genus *Crocidophora* Lederer.102. *Crocidophora zinghalis* (Walker).

*Samea zinghalis* WALKER, List Lep. Het. B. M., XVII, 1859, p. 468.

One specimen taken at Los Indios, November, 1912.

Genus *Pionea* Guenée.103. *Pionea fuscualis* Hampson.

*Pionea fuscualis* HAMPSON, Proc. Zoöl. Soc. London, 1899, p. 243.

A single individual, taken August 19, Nueva Gerona.



Genus **Pyrausta** Schrank.

104. **Pyrausta cardinalis** (Guenée).

*Synchromia cardinalis* GUENÉE, Spec. Gén., VIII, 1854, p. 188, Pl. VII, fig. 6.

A dwarfed specimen taken at Los Indios by J. L. Graf, May 18, 1910.

105. **Pyrausta phœnicealis** (Hübner).

*Hamatia phœnicealis* HÜBNER, Zutr. Exot. Schmett., IV, 1818-1837, Pl. 511 (20),  
figs. 115, 116.

One specimen collected August 2, 1912, at Nueva Gerona.

Genus **Argyria** Hübner.

106. **Argyria auratella** (Clemens).

*Crambus auratellus* CLEMENS, Proc. Acad. Nat. Sci. Philada., XII, 1860, p. 204.

One example, Los Indios, November.

Family TORTRICIDÆ.

Genus **Cacœcia** Hübner.

107. **Cacœcia** sp?

One specimen taken at Nueva Gerona, June 4, 1912.

Mr. August Busck, to whom I submitted the specimen, informs me that at present he cannot name the species.

Family ANAPHORIDÆ.

Genus **Anaphora** Clemens.

108. **Anaphora?** sp. (?).

One specimen from Nueva Gerona, which Mr. Busck does not venture to name.

109. **Anaphora?** sp. (?).

One specimen from the same locality, to which the remark under the preceding number (108) also applies.

The Anaphoridæ are a difficult group, the number of species in which has greatly increased as the result of recent collections in the American tropics, and as certainty as to generic and specific distinctions demands dissection and careful study of a considerable series of specimens, Mr. Busck, who is our leading authority upon the group, seemed to feel that it is inadvisable to attempt to locate the last two species, which are here cataloged.

CARNEGIE MUSEUM,

May 25, 1916.

## PLATE XXXI.

- FIG. 1. *Proteides idas* var. *san-antonio* (Lucas), upper side.  
FIG. 2. *Proteides idas* var. *san-antonio* (Lucas), lower side.  
FIG. 3. *Melanthes otreus otreus* (Cramer), ♀.  
FIG. 4. *Melanthes otreus brunnea* (Herrich-Schaeffer), ♀.  
FIG. 5. *Melanthes otreus brunnea* (Herrich-Schaeffer), ♂.  
FIG. 6. *Eudamus santiago* Lucas, under side.  
FIG. 7. *Amblyscirtes insulæ-pinorum* Holland, ♂, under side (sp. nov.).  
FIG. 8. *Amblyscirtes insulæ-pinorum* Holland, ♀, under side (sp. nov.).  
FIG. 9. *Asbolis sandarac* (Herrich-Schaeffer), ♀.  
FIG. 10. *Phemiades antiqua* (Herrich-Schaeffer), ♂.  
FIG. 11. *Epargyreus maysi* (Lucas), upper side.  
FIG. 12. *Epargyreus maysi* (Lucas), lower side.  
FIG. 13. *Prenes corrupta* (Herrich-Schaeffer), under side.  
FIG. 14. *Atalopedes cunaxa* (Hewitson), ♀, lower side.  
FIG. 15. *Limochores baracoa* (Lucas).  
FIG. 16. *Cydosia linki* Holland, sp. nov.



Lepidoptera of the Isle of Pines.



XIX. A LIST OF THE ODONATA COLLECTED ON THE  
ISLE OF PINES BY MR. J. L. GRAF IN 1910, AND BY  
MR. G. A. LINK IN 1912-1913, NOW CONTAINED  
IN THE CARNEGIE MUSEUM.

BY HUGO KAHL.

Mr. J. L. Graf, who was a member of the party which made a brief visit to the Isle of Pines in 1910, was especially interested in collecting the Odonata, of which he brought back with him more than five hundred specimens, representing twenty-four species. These are accessed in the Museum under our Accession No. 4169. Mr. G. A. Link, Sr., who made a stay of more than a year upon the island, during which he was principally engaged in collecting birds, also collected such insects as he found the time to take and preserve. Among them are a number of Odonata, which are accessed under Nos. 4658 and 4745. The collection is probably the most perfect which has been taken upon the island, though it may well be that there are some species which have been overlooked.

The arrangement of the genera in this paper follows that of Muttowski in the *Catalogue of the Odonata of North America*, published by the Public Museum of the City of Milwaukee.

Order *ODONATA* Fabricius.

Suborder *ZYGOPTERA* Selys.

Genus *LESTES* Leach.

1. *Lestes tenuatus* Rambur.

*Lestes tenuatus* RAMBUR, Ins. Neur., 1842, p. 245.

Fourteen males and nine females, of which seven pairs were captured *in coitu*. They were taken at Nueva Gerona, May 11, 1910, by J. L. Graf.

Genus *ARGIALLAGMA* Selys.

2. *Argiallagma minutum* (Selys).

*Trichocnemis minuta* SELYS, in Sagra's Hist. Nat. de Cuba, VII, 1857, p. 164.

A male and female taken at Nueva Gerona, May 9, and a female taken at Los Indios, May 19, 1910, by J. L. Graf. In the female



from Nueva Gerona the apical spine of ventral segment 8 is distinct, but I cannot find any indication of it in the female from Los Indios.

Genus *ENALLAGMA* Charpentier.

3. *Enallagma cardenium* (Selys).

*Agrion cardenium* (HAGEN, MS.) SELYS, Bull. Acad. Belg. (2), XLI, 1876, p. 530.

Two males, Nueva Gerona, May 9, and one male, Los Indios, May 19, 1910, collected by J. L. Graf. The superior and inferior appendages are exactly as described by Scudder under "*? Agrion (Ishnura) cæcum* Hagen" (cf. *Proc. Bost. Soc. Nat. Hist.*, X, 1866, p. 189). The specimens agree exactly with the description cited above from De Selys's paper in the *Bulletin* of the Belgian Academy.

Genus *ANOMALAGRION* Selys.

4. *Anomalagrion hastatum* (Say).

*Agrion hastatum* SAY, Journ. Acad. Nat. Sci. Philada., VII, 1839, p. 38

One male taken at Nueva Gerona, July 25, 1912, by G. A. Link, Sr.

Genus *CERATURA* Selys.

5. *Ceratura capreola* (Hagen).

*Agrion capreolus* HAGEN, Syn. Neur. N. America, 1861, p. 78.

Four males and seven females taken at Nueva Gerona, May 5 and 11, 1910, by J. L. Graf. Three pairs were taken *in coitu*, two of which have "orange" females and the other pair a "black" female. There are four "orange" females, all alike, with the thorax orange or citron-colored, and with a mid-dorsal black stripe, and abdominal segment 1 entirely orange or citron-colored without any trace of black. There is a brown-red female, which may have originally been "orange" and become discolored, marked in the same way as the "orange" females and with abdominal segment 1 unicolorous brown-red. All the males and females have on the labrum a basal, transverse, black line, which is slightly extended at the middle. In none is the labrum entirely yellow. The number of postcubitals, with some variations, is six in the front wings and five in the hind wings. One male has in both front wings seven postcubitals between the costa and the median vein, but only six between the latter and the principal sector. In none are there more than six postorbitals between the principal sector and the median vein. One "black"

female has six postcubitals in the right front wing, but in the left wing there are three supernumerary veins between the costa and the median vein, one between postcubitals 2 and 3, one between postcubitals 4 and 5, and one beyond postcubital 6; this same female has in both hind wings six postcubitals between the costa and the median vein, and five between the latter and the principal sector. In no other specimen are there more than five postcubitals in the hind wings.

Genus *NEONEURA* Selys.

6. *Neoneura maria* (Scudder).

*Agrion maria* SCUDDER, Proc. Bost. Soc. Nat. Hist., X, 1866, p. 188.

Four males taken at Nueva Geróna, May 9, 1910, by J. L. Graf; a male and female *in coitu* taken at the same place by G. A. Link, August 6, 1912.

Genus *PROTONEURA* Selys.

7. *Protoneura capillaris* (Rambur).

*Agrion capillare* RAMBUR, Ins. Neur., 1842, p. 280.

One male taken by J. L. Graf at Nueva Geróna, May 9, 1910.

The unique male, which I refer with some doubt to this species, agrees with the description given by Selys (*Bull. Acad. Belg.* (2), X, 1860, p. 461) as far as it goes, except that I do not find a trace of "une grande tache vert azuré pâle" on the third abdominal segment. The measurements given by Selys are: "Abdomen environ 25. Aile inférieure 17 (large de  $2\frac{1}{2}$ );" Hagen has: "Length near 20 millim. Alar expanse 35 millim." The specimen from the Isle of Pines has: Abdomen about 27 mm.; hind wing about 16 mm.; alar expanse about 35 mm.

As the description given by Selys in 1886 (*Mém. Cour. Acad. R. Belg.*, XXXVIII, p. 212) amending the very brief diagnosis given in Sagra's *Historia Natural de Cuba*, VII, 1857, p. 470, is generally inaccessible, I deem it advisable to give a description of this male from the Isle of Pines, which is as follows:

Inferior sector of the triangle (here long, rectangular) entirely absent. Pterostigma rhomboidal with one entire cell below, alike in all four wings. Subnodal sector from the vein of the nodus as in *P. corculum* Calvert and *P. amatoria* Calvert (*Biol. Centr. Amer.*, 1907, Pl. X, figs. 44 and 52); superior sector of the triangle in front wings ending at the cross-vein descending from the nodus, but in both hind

wings this sector reaches quite perceptibly beyond this cross-vein; nodal sector in front wings exactly at the fifth postcubital, in hind wings at the fourth postcubital. Thoracic dorsum beautifully black-violaceous, shining ("Thorax azuré, le devant noir-violet," Selys); second lateral suture with a rather broad, black stripe from the base of hind wings, extending between the second and third coxæ; labrum shining, blue-black, with the anterior margin pale yellow; anteclypeus shining, blue-black as the labrum; postclypeus slightly shining, bluish gray, at the middle apparently divided longitudinally by a narrow black stripe; front and vertex chiefly black-violaceous, shining, but not as much as the labrum and anteclypeus; antennæ black; mandibles brown-red; labial portions rather pale yellow, but the structures not readily seen; legs pale yellow; femora slightly pale bluish, the same color encircles the first and second femora at apex; a pale annulus at their middle; the tibia annulated by brownish, and with the apical one third of the posterior tibiæ brown; tarsi brown; claws dark brown-red, tipped with black and with a minute tooth before the apex. Abdominal segments 1 and 2 above black-violaceous, which color expands at apex to the lateral margin of each segment, the rest of the two segments yellowish; copulatory organs reddish brown; segments 3, 4, 5, and 6 blackish brown, each with the base and apex darker, slightly violaceous; at the extreme base of 3 a pale spot, and 4, 5, and 6 each with a narrow, yellowish ring at base; 7 slightly violaceous with a little less than the basal half and the lateral margin yellowish; 8 violaceous with the lateral margin rather broadly yellow; 9 and 10 black-green with the base of 9 slightly violaceous; dorsum of 10 with an apical, angular incision; anal appendages hardly shorter than 10; superior and inferior appendages of about equal extension, the former dark brown with black tips; the inferior appendages yellow with black tips, narrowed beyond the middle and then widened gradually to apex, which is obliquely truncate; seen from below the inferior appendages are curved so as to form the shape of a lyre with their tips diverging.

Suborder ANISOPTERA Selys.

Genus GYNACANTHA Rambur.

8. *Gynacantha nervosa* Rambur.

*Gynacantha nervosa* RAMBUR, Ins. Neur., 1842, p. 213.

One female taken at Nueva Gerona by Link on September 11, 1912.

Genus *ÆSCHNA* Fabricius.9. *Æschna* (*Coryphæschna*) *adnexa* Hagen.

*Æschna adnexa* HAGEN, Syn. Neur. N. Amer., 1861, p. 127.

One male taken at Nueva Gerona by Graf, May 14, 1910, and a female (appendages broken off) taken at the same place by Link, June 10, 1912.

10. *Æschna* (*Coryphæschna*) *virens* Rambur.

*Æschna virens* RAMBUR, Ins. Neur., 1842, p. 192.

Three males, Nueva Gerona, collected by Link, August 24 and September 11, 1912.

Genus *LIBELLULA* Linnæus.11. *Libellula auripennis* Burmeister.

*Libellula auripennis* BURMEISTER, Handb. Ent., II, 1839, p. 861.

Seventeen males and fifteen females taken by Graf at Nueva Gerona and Los Indios, May, 1910; and one female taken by Link at Nueva Gerona, May 31, 1912.

Genus *ORTHEMIS* Hagen.12. *Orthemis ferruginea* (Fabricius).

*Libellula ferruginea* FABRICIUS, Syst. Ent., 1775, p. 423.

Twelve males taken at Nueva Gerona by Graf in May, 1910, and five males taken at the same place by Link during August and September, 1912.

Genus *CANNAPHILA* Kirby.13. *Cannaphila insularis funerea* Carpenter.

*Cannaphila insularis* KIRBY, Trans. Zoöl. Soc. London, XII, 1889, p. 341.

*Cannaphila funerea* CARPENTER, Proc. Dublin Soc., VIII, 1897, p. 434.

Twenty-one males and fourteen females taken at Nueva Gerona and Los Indios by Graf in May, 1910.

Genus *PERITHEMIS* Hagen.14. *Perithemis domitia* (Drury).

*Libellula domitia* DRURY, Illustr. Exot. Ent., II, 1773, Pl. XLV, fig. 4.

Eight males taken at Nueva Gerona and Los Indios by Graf in May, 1910.

## Genus MICRATHYRIA Kirby.

15. *Micrathyria æqualis* (Hagen).

*Dythemis æqualis* HAGEN, Syn. Neur. N. Amer., 1861, p. 167.

Five males taken at Nueva Gerona and a male and female taken at Los Indios in May, 1910, by J. L. Graf.

16. *Micrathyria didyma* (Selys).

*Libellula didyma* SELYS, in SAGRA'S Hist. Nat. de Cuba, VII, 1857, p. 453.

A male and a female taken at Nueva Gerona and two males captured at Los Indios in May, 1910, by Graf.

17. *Micrathyria dissocians* Calvert.

*Micrathyria dissocians* CALVERT, Biol. Cent.-Amer., Ins. Neur., 1906, p. 226, Pl. IX, figs. 19-21.

Four males taken by Graf at Nueva Gerona, May 5-14, 1910.

## Genus ERYTHRODIPLAX Brauer.

18. *Erythrodiplax berenice* subsp. *næva* (Hagen).

*Dythemis næva* HAGEN, Syn. Neur. N. Amer., 1861, p. 167.

One male taken at Nueva Gerona by Link, September 2, 1912.

The front wings with the internal triangles two-celled; the discoidal triangle in the left wing two-celled, in the right wing free.

19. *Erythrodiplax minuscula* (Rambur).

*Libellula minuscula* RAMBUR, Ins. Neur., 1842, p. 115.

Two females, Nueva Gerona, May 9; one female, Los Indios, May 20, 1910.

The specimens were collected by J. L. Graf.

20. *Erythrodiplax ochracea* (Burmeister).

*Libellula ochracea* BURMEISTER, Handb. Ent., II, 1839, p. 854.

Numerous specimens of both sexes taken at Nueva Gerona, Los Indios, and Columbia by Graf in the month of May, 1910, and by G. A. Link, Sr., from July to September, 1912.

21. *Erythrodiplax connata justiniana* (Selys).

*Libellula connata* BURMEISTER, Handb. Ent., II, 1839, p. 855.

*Libellula justiniana* SELYS, in SAGRA'S Hist. Nat. de Cuba, VII, 1857, p. 181.

Numerous specimens taken by Graf at Nueva Gerona and Los Indios in May, 1910, and by Link at the same localities from July to September, 1912.



22. **Erythrodiplax connata fraterna** (Hagen).

*Libellula connata* BURMEISTER, Handb. Ent., II, 1839, p. 855.

*Diplax fraterna* HAGEN, Proc. Boston Soc. Nat. Hist., XV, 1873, p. 375.

Numerous specimens from Nueva Gerona taken by Link, June-September, 1912.

23. **Erythrodiplax umbrata** (Linnæus).

*Libellula umbrata* LINNÆUS, Syst. Nat., Ed. X, 1758, p. 545.

The collection contains twelve males and fourteen heterochromatic females taken at Nueva Gerona and Los Indios by Graf in May, 1910, and nine males, seven heterochromatic females and one homœochromatic female, taken by Link from July to September, 1912.

Genus ERYTHEMIS Calvert.

24. **Erythemis simplicicollis** (Say).

*Libellula simplicicollis* SAY, Journ. Acad. Nat. Sci. Philada., VIII, 1839, p. 28.

There are four males and six females captured at Nueva Gerona and Los Indios by Graf in May, 1910, and a male and two females taken at Nueva Gerona by Link in May and June, 1912.

25. **Erythemis verbenata** (Hagen).

*Lepthemis verbenata* HAGEN, Syn. Neur. N. Amer., 1861, p. 162.

Three males taken by J. L. Graf at Nueva Gerona, May, 1910.

Genus LEPTHEMIS Hagen.

26. **Lepthemis vesiculosa** (Fabricius).

*Libellula vesiculosa* FABRICIUS, Syst. Ent., 1775, p. 421.

Six males and one female collected by J. L. Graf, May, 1910, at Nueva Gerona.

Genus BRACHYMESIA Kirby.

27. **Brachymesia batesi** (Kirby).

*Cannacria batesi* KIRBY, Trans. Zool. Soc. London, XII, 1889, p. 341.

One female collected by Graf at Nueva Gerona, May 14, 1910.

Genus DYTHEMIS Hagen.

28. **Dythemis rufinervis** (Burmeister).

*Libellula rufinervis* BURMEISTER, Handb. Ent., II, 1839, p. 850.

Six males and one female taken at Los Indios and a male taken at Nueva Gerona by Graf in May, 1910; and one male taken by Link at Nueva Gerona, September 9, 1912.

## Genus MACROTHEMIS Hagen.

29. *Macrothemis celæno* (Selys).

*Libellula celæno* SELYS, in SAGRA'S Hist. Nat. de Cuba, VII, 1857, p. 454.

Four males and three females taken at Nueva Gerona and Los Indios by Graf in May, 1910, and a male and female taken at Nueva Gerona by Link in July and August respectively, 1912.

## Genus THOLYMIS Hagen.

30. *Tholymis citrina* Hagen.

*Tholymis citrina* HAGEN, Stett. Ent. Zeitung, XXVIII, 1867, p. 218.

One male taken by Graf at Los Indios, May 20, 1910.

Hind wings each with two cross-veins on bridge, one of which is nodal, the other proximal and far distant; in the left wing there is a third cross-vein, situated at the proximal end.

## Genus PANTALA Hagen.

31. *Pantala flavescens* (Fabricius).

*Libellula flavescens* FABRICIUS, Ent. Syst., Suppl., 1798, p. 285.

One female taken at Nueva Gerona by G. A. Link, June 14, 1912.

## Genus TRAMEA Hagen.

32. *Tramea insularis* Hagen.

*Tramea insularis* HAGEN, Syn. Neur. N. Amer., 1861, p. 146.

Three females taken at Nueva Gerona May 6, and one male captured at Los Indios, May 19, 1910, by J. L. Graf; and a male and female taken by G. A. Link, Sr., respectively in May and June, 1912.

## PSEUDONEUROPTERA.

## Family CHRYSOPIDÆ.

## Genus CHRYSOPA Leach.

33. *Chrysopa* sp.?

Thirty-three specimens taken at Nueva Gerona, July 27, 1912.

## Family ASCALAPHIDÆ.

## Genus ULULODES Currie.

34. *Ululodes hyalinus* (Latreille).

*Ascalaphus hyalinus* LATREILLE, in Humboldt Recueil, II, p. 118, Pl. XL, fig. 7.

Two specimens, one taken at Nueva Gerona, the other at McKinley, both at the end of July.

## XX. A TRIP TO ISLANDS IN LAKE ERIE.

BY CALVIN GOODRICH.

Some of the older American collections contain land-shells of peculiar form and pattern, the locality for which is given as "Strontian Island, Lake Erie." There is reference to the island in Binney & Bland, page 153, and in Binney's *Manual*, pages 480 and 492.

Mr. George H. Clapp, failing to find Strontian Island on available maps, wrote me in the winter of 1914-15 for information regarding it, suggesting that it might be a local name, which had failed to get recognition from the official chart-makers and, that, as I lived in the region, I might know, or might learn, what the true name was. It happened that I could give the information. The correspondence led to a proposal for a visit to Strontian Island, now Green Island, as well as for the exploration of other bodies of land in the lake. Dr. Bryant Walker was sounded and he gladly agreed to become a third member of the expedition. Mr. Lucas Beecher of Toledo volunteered as "navigating officer", and the powerboat "La France," Captain Woodruff, was chartered.

The party left Toledo the afternoon of July 2, 1915, and made West Sister Island at twilight, collecting being deferred until the next morning. The island is inhabited only by the lightkeeper, his wife, and a helper. In the sixty and more years during which the light has been maintained, the island has been grazed over by many generations of cows and fed over by untold flocks of chickens and turkeys. On our visit we scared numbers of Belgian hares from the undergrowth. West Sister must have had an enormous molluscan population at one time, as the "bones" carpeted the ground. But snails are now very scarce, being confined mostly to "small stuff" and to two or three of the larger species, which, living under the bigger logs or deep in the humus, have escaped extinction. There is even a noticeable decrease since a visit I made to the island in 1913. Our collecting here, as well as our breathing and eating, was made difficult by the *Ephemeridæ*, then just past the climax of their swarming. West Sister is a jewel in a ring of sounding waves, but because of the May-flies we were glad to leave it.

An hour's run in a rising sea brought us to Green Island, once Strontian. We anchored in its lee and went ashore in the "dinky," a craft admirable for towing but something of a mistake for purposes of navigation. Landing, we entered almost immediately upon a paradise of snails. A slow rain was falling and the animals were making the most of it. They were everywhere—on timbers, weeds, in the grass, among the roots of trees, even on the concrete walk which led from the boat-house to the light. One could scarcely walk without treading on them. In one tangle of decaying weeds scores were taken. I collected about three hundred specimens, Mr. Walker as many, and Mr. Clapp many more. It was all a matter of reaching the point of satiation. There was no need to get off the "avenue" through which the walk ran. That there were so many here, while at West Sister there were so few, may be explained by the fact that on Green Island the chickens were confined, and there were apparently no cattle to clean out the underbrush.

In the afternoon we hurried on to Middle Island, confident of making another big haul. But we were booked for disappointment. Middle Island, belonging to Ontario, has a lighthouse, chickens, and turkeys. The snails, what there were of them, had to be quarried for. Most of them were under flat rocks on the north shore. The weather was steamy, the May-flies a nuisance.

The next day we came upon the rival of the Green Island snailery. It was Middle Sister Island, lying in Canadian waters at the western extreme of this island group. For a collecting receptacle, Mr. Clapp had chosen one of those cylindrical cans in which certain brands of biscuits are packed, declaring in advance that, in event of abundance, he would be temperate. But the can was soon filled and he was glad to borrow a bag. The snails were plentiful on low as well as on high ground, in the thick woods, and in the weeds within reach of the wash of northwest storms. They seemed particularly partial to the Herb Robert (*Geranium Robertianum*), a plant about ankle-high and very pungent when broken or bruised. The island has never been inhabited by man, except for short periods, in which professional fishermen assumed squatter rights. Fortunately for collectors they brought with them no chickens, at least living ones.

At noon we turned eastward again and made a landing on North Harbor Island. It was a rookery for terns, and it was necessary to watch every step to avoid treading on eggs and nestlings. The haul

here, though it would have been fair for mainland collecting, seemed insignificant after Middle Sister.

East Sister, close by, was a large island and had been cultivated in previous years. The picking was small, the gaps between snails long, and the *Ephemeridæ* a plague. We "did" one end of the island, the only promising part, and rowed back to the powerboat. We had planned to make Hen Island before dark and, if possible, one or both of the islets known as the Chickens. Halfway to Hen Island, a storm forced the revision of plans, a sudden change of course, and flight to shelter at Put-in-Bay. This proved to be one of the worst gales of the season and reluctantly on the fourth we gave up hope of visiting other islands, the aspect of which from the lake indicated habitation by snails. Some collecting was done at Put-in-Bay, but without turning up anything not represented in Mr. John A. Allen's list, recently published in the *Nautilus*. The shells here corresponded to those of the mainland and might tend to show that, as an island, Put-in-Bay is of more recent formation than the other islands.

The rocks of the islands we visited belong to the Silurian series known as Monroe. Where the exposure is on the water, the rocks are very much weathered. In some places they are cut and carved into picturesque caves. With geologists the islands are most distinguished for their glacial records. Upon nearly all of them are beautiful grooves and striæ, sculptured by the ice. One series of grooves on North Harbor Island was utilized extensively by the nesting terns.

The basin of Lake Erie was originally a shallow valley with free drainage. In the successive stages in which the ice wall retreated and lakes formed at its foot (Lakes Maumee, Whittlesey, Wayne, and Warren) what are now the Erie islands were covered with ice and water. In the Lake Algonquin stage, in which the upper lakes discharged through three outlets instead of one as at present (if the the artificial Chicago drainage canal be excepted) the lowlands between Lakes Huron and Erie were uncovered, Lake Erie fell to a level below that of to-day, and the islands appeared above the waters. For a time a few of them may have been parts of the principal land-mass. Probably the peopling of the islands with animal and vegetable life began at this period. Later, and after the final passing of the glacial ice, the Great Lakes passed into the Nipissing stage, the Chicago outlet was closed and an increased volume of water poured through Lake St. Clair and the Detroit river. Still higher water came when



a second outlet, that through the Ottawa river, closed. If new islands have been formed since, their island career has no relation to glacial history. They were formed simply through the agency of erosion.

We hope at some future date to pay a more leisurely visit to these islands and make a more thorough study of the geology and botany with the idea of getting additional light on their age, as this may indicate how long it takes a species, such as *Pyramidula solitaria*—which goes back to inter- if not pre-glacial time unchanged from its present typical form—to change to distinct, and strongly marked races, as on the islands.

For purposes of record, the findings at the different islands are here set down:

WEST SISTER ISLAND, OHIO.

<i>Polygyra albolabris</i> (Say)	<i>Helicodiscus parallelus</i> (Say)
<i>profunda strontiana</i> Clapp.	<i>Punctum pygmaeum</i> (Draper)
<i>zaleta</i> (Binney)	<i>Bifidaria armifera</i> (Say)
<i>elevata</i> (Say)	<i>contracta</i> (Say)
<i>inflecta</i> (Say)	<i>holzingeri</i> Sterki.
<i>monodon fraterna</i> (Say)	<i>tappaniana</i> (Adams)
<i>Vitrea indentata</i> (Say)	<i>pentodon</i> (Say)
<i>Zonitoides arboreus</i> (Say)	<i>Vertigo milium</i> Giddings
<i>minusculus</i> (Binney)	<i>Vallonia pulchella</i> (Müller)
<i>Pyramidula solitaria</i> (Say)	<i>parvula</i> Sterki.
<i>alternata eriensis</i> Clapp.	<i>Carychium exiguum</i> Say.
<i>cronkhitei anthonyi</i> Pilsbry	

GREEN ISLAND, OHIO (FORMERLY STRONTIAN ISLAND).

<i>Polygyra profunda strontiana</i> Clapp
<i>zaleta</i> (Binney)
<i>inflecta</i> (Say)
<i>Pyramidula solitaria strontiana</i> Clapp.
<i>alternata eriensis</i> Clapp.
<i>Succinea avara</i> Say.

MIDDLE ISLAND, ONTARIO.

<i>Polygyra profunda</i> (Say)	<i>Zonitoides arboreus</i> (Say)
<i>zaleta</i> (Binney)	<i>minusculus</i> (Binney)
<i>palliat</i> (Say)	<i>Circinaria concava</i> (Say)
<i>fraudulenta</i> Pilsbry	<i>Bifidaria armifera</i> (Say)
<i>inflecta</i> (Say)	<i>contracta</i> (Say)
<i>monodon fraterna</i> (Say)	<i>corticaria</i> (Say)
<i>Pyramidula solitaria</i> Say	<i>Vallonia parvula</i> Sterki.
<i>solitaria roseo-apicata</i> Clapp.	<i>Succinea avara</i> Say.
<i>alternata</i> (Say)	

## MIDDLE SISTER ISLAND, ONTARIO.

<i>Polygyra albolabris goodrichi</i> Clapp.	<i>Helicodiscus parallelus</i> (Say)
<i>zaleta</i> (Binney)	<i>Circinaria concava</i> (Say)
<i>profunda strontiana</i> Clapp.	<i>Bifidaria contracta</i> (Say)
<i>thyroides</i> (Say)	<i>Succinea avara</i> (Say)
<i>inflecta</i> (Say)	
<i>fraudulenta</i> Pilsbry	
<i>Pyramidula solitaria strontiana</i> Clapp.	
<i>alternata eriensis</i> Clapp.	

## NORTH HARBOR ISLAND, ONTARIO.

<i>Polygyra albolabris goodrichi</i> Clapp.	<i>Pyramidula solitaria roseo-apicata</i> Clapp.
<i>profunda strontiana</i> Clapp.	<i>alternata eriensis</i> Clapp.
<i>inflecta</i> (Say)	<i>Circinaria concava</i> (Say)
<i>fraudulenta</i> Pilsbry	

## EAST SISTER ISLAND, ONTARIO.

<i>Polygyra zaleta</i> (Binney)	<i>Pyramidula solitaria roseo-apicata</i> Clapp.
<i>profunda</i> (Say)	<i>alternata</i> (Say)
<i>inflecta</i> (Say)	<i>Ariolimax campestris</i> (Binney)
<i>Vitrea hammonis electrina</i> (Gould)	<i>Succinea avara</i> Say.
<i>Zonitoides arboreus</i> (Say)	<i>Bifidaria contracta</i> (Say)
	<i>Vallonia parvula</i> Sterki var(?)

## MOUSE ISLAND, OHIO—VISITED IN 1912.

<i>Polygyra albolabris</i> (Say)	<i>Pyramidula solitaria mousensis</i> Clapp.
<i>profunda strontiana</i> Clapp.	<i>alternata</i> (Say)
<i>inflecta</i> (Say)	<i>Zonitoides arboreus</i> (Say)

# XXI. NOTES ON THE LAND-SHELLS OF THE ISLANDS AT THE WESTERN END OF LAKE ERIE AND DESCRIPTIONS OF NEW VARIETIES.

BY GEORGE H. CLAPP.

Many of the larger shells of these islands show distinct insular modification, so distinct in fact as to make them readily recognizable when once seen. Others are indistinguishable from the mainland forms, and this is particularly true of the shells of Put-in Bay, where there seems to have been no change in the species we found.

Both Dr. Walker and Mr. Goodrich, who have carefully gone over these shells, and to whom I am indebted for valuable suggestions, agree with me in considering the forms described below as worthy of varietal rank.

## I. *Pyramidula solitaria strontiana* var. nov.

Shell very heavy, coarsely striate, *uniform straw-color without a trace of bands*. Most specimens show traces of impressed spiral lines. This variety is much more elevated, heavier, and smaller than the typical banded form from the mainland, and, as it is found in many of the older collections of North American land-shells, the locality being given as "Strontian Island, Lake Erie," I have thought it well to perpetuate the name, although the island is now "officially" known as Green Island.

We collected several hundred specimens on our visit to the island, July 3, 1915, and thousands could easily have been gathered.

Ninety-nine mature shells, that is those showing a thickening of the lip, were measured with the following result:

Diam.	24.3,	Alt.	17.66 mm.,	Index,	$\frac{A}{D}$ , 72.65 average,
"	27.5,	"	21.00	"	" 76.36 largest,
"	22.5,	"	17.00	"	" 75.56 smallest,
"	26.0,	"	20.50	"	" 78.85 most elevated,
"	25.0,	"	16.50	"	" 66.00 " depressed.

Variation in diam. from 22.5 to 27.5 or 5 mm.

" alt. " 16.0 " 21.0 " 5 "

Ninety-five shells varied in diam. from 23.0 to 26.5 or 3.5 mm.

Ninety-four " alt. " 16.0 " 19.0 " 3.0 "

For comparison nineteen shells from seven mainland localities were measured. They gave an average diameter of 26.75 mm. and an index of 69.35, the greatest index being 72.8.

Type-locality Green (formerly Strontian) Island, Lake Erie, Ohio. Types No. 7462 of my collection. Paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

On Middle Sister Island a few specimens of this same high, bandless variety were found. They were too few, however, to make comparative measurements, but they apparently run larger.

This is not "*Pyr. solitaria albina* (W. G. Binney)" of Walker, *Terrestrial Mollusca of Michigan*, 1899, p. 22, without description, as the locality is there given as "Kent Co." In "*An Illustrated Catalogue of the Mollusca of Michigan*," by Bryant Walker, *Rep. State Board Geol. Surv. Mich.*, 1905, p. 492, Binney's figure 268 is copied from the *Manual of American Land-Shell*s, p. 254 and the name under the original figure is changed from "Var. *albino*" to "Var. *albina* (Binney)" and the statement is made: "The variety has been reported from Kent county only."<sup>1</sup>

Binney probably never intended to make this a variety. In *Land and Fresh-Water Shells of North America*, Vol. I, p. 71, it is figured with the type as "*Helix solitaria* and *albino*." In *Terrestrial Mollusca*, Vol. V, it is not listed as a variety in the Catalogue on p. 77, and on p. 156 it is figured separately as "Var. *albino*." If he had intended to describe it formally as a variety, he would surely have given the name a Latin termination. It would seem, therefore, that var. *albina* (W. G. Binney) Walker must be limited to albinos of the typical banded form of the mainland.

Binney's figure was probably drawn from one of the small shells of Strontian Island, as he had them in his collection. No. 38987 of

<sup>1</sup> Dr. Walker has kindly furnished the following description:

### ***Pyramidula solitaria albina* Walker.**

*Pyramidula solitaria albina* WALKER, Ill. Cat. Moll. Mich., p. 492 (exc. of figure), 1906.

"This form was based on a single example in the DeCamp Collection, (No. 11650 Coll. Walker), from Kent County, Michigan. It is a thin greenish-white shell, slightly tinged with pale horn-color. It is evidently not quite mature, as the lip is thin and sharp. It has  $4\frac{1}{2}$  whorls and measures, diam. 21.5, alt. 16 mm. Compared with the variety from Green (Strontian) Island, which was probably the original of the figure copied erroneously from Binney, it is a much thinner shell and differs conspicuously in color."

the Binney collection, now in the National Museum, is labeled "Strontian Isl. and Cunninghams Isl., L. Erie" and under remarks "Albino." Cunninghams is now known as Kelley's Island.

All these shells from Strontian Island were undoubtedly distributed by the late Dr. E. W. Hubbard, who lived for many years at Elyria, O. I have them in the collection of Dr. Jas. Lewis, of Sanderson Smith, and in part of Dr. Hubbard's collection, all from that source. In the A. D. Brown Collection in the Academy of Natural Sciences of Philadelphia, are four specimens, and Brown's label says: "E. W. H."

## 2. *Pyramidula solitaria roseo-apicata* var. nov.

On North Harbor Island a smaller and still more elevated race with a *pink apex* was found.

Shell small, elevated, very heavy, with the *apical whorls pink*. In color they are generally darker than var. *strontiana*, some being almost chestnut and others brownish straw-color, mottled with chestnut on the upper whorls. Mature shells are mostly largely denuded, the epidermis which remains being in ragged patches. The *pink apex* is a very marked character in this variety and this feature, together with the darker color and smaller size, readily separates it from *strontiana*.

This variety is particularly interesting in showing the gradual loss of the bands. Of one hundred and nine shells collected by the writer seven had two strong bands, fourteen had one or two weak bands and eighty-eight were without bands. Sixty-seven fully mature, unbanded shells were measured, with the following result:

Diam.	22.55,	Alt.	17.36	mm.,	Index,	76.98	average,
"	25.50,	"	19.50	"	"	76.48	largest,
"	19.50,	"	14.00	"	"	71.80	smallest and most depressed,
"	21.00,	"	17.50	"	"	83.33	most elevated,
"	22.14,	"	17.00	"	"	76.79	average of 7 banded,
"	22.53,	"	17.33	"	"	76.92	" " 74 shells.

Variation in diam. of unbanded shells from 19.5 to 25.5 or 6.0 mm.

" alt. " " " " 14.0 " 19.5 " 5.5 "

Sixty bandless shells varied in diam. from 20.5 to 24.5 or 4 mm.

Sixty-four " " " " alt. " 15.5 " 19.0 " 3.5 "

Type-locality North Harbor Island, Lake Erie, Ontario. Types No. 7463 of my collection. Paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

The dimensions given for *solitaria* by Binney in the *Manual* are



evidently wrong, as he gives the greater diam. as 25 mm., while Say gives the size as "nearly  $1\frac{1}{2}$  inch," or about 29 mm., and *The Terrestrial Mollusca* says "over  $1\frac{1}{4}$  inch," or about 32 mm.

### 3. *Pyramidula solitaria mynesites*\* var. nov.

On Mouse Island, a small island at the end of Catawba Id., Ottawa Co., Ohio, Mr. Goodrich found a small form of *solitaria* which is so distinct from all of the other forms of the region that I distinguish it by the above varietal name.

Shell small, solid, straw-colored, with two brown bands, the lower wider and darker than the upper one which is sometimes almost obsolete. Apex pink like var. *roseo-apicata*. Whorls  $5\frac{1}{2}$ .

Compared with vars. *strontiana* and *roseo-apicata* it is constantly much smaller and intermediate in color, but with the banding of the latter. Over two hundred were collected and measurements of thirty-seven mature shells gave the following results:

Diam.	20.12,	Alt.	14.61	mm.,	Index	72.61	average,
"	21.00,	"	16.00	"	"	76.20	largest,
"	18.50,	"	13.50	"	"	72.97	smallest,
"	20.00,	"	16.00	"	"	80.00	most elevated,
"	20.50,	"	14.00	"	"	68.30	depressed.

Types No. 7232 of my collection. Paratypes in collections of Bryant Walker, Detroit, Mich., and Calvin Goodrich, Toledo, Ohio.

In May 1916 Mr. Goodrich again visited Mouse Island, and collected a large number of *P. solitaria*, many of them juvenile, however. In a letter he says: "The *solitaria* ranged bigger than in my collecting of 1912, but compared with other findings I believe the form will stand as a dwarf race." The largest shell found this year measures  $23.5 \times 18.5$  mm., index 78.72, and the smallest,  $18.5 \times 12$  mm., index 70.28. The average of twenty-nine shells measured is  $21.20 \times 15.26$  mm., index 71.98. Mr. Goodrich also made a study of the banding of two hundred forty-one shells, adult and young, and found that two were bandless, thirteen had a single band and one hundred seventy-seven had the lower band stronger than the upper.

### 4. *Pyramidula alternata eriensis* var. nov.

On the islands at the western end of Lake Erie and the islands of Maumee Bay, Michigan, a very heavy, roughly ribbed, elevated,

\*From *μῦς* = mouse; *νησίτης* = islander.

dark variety of *alternata* is found, to which the above name may be given. So far as seen it reaches its greatest development on Middle Sister Island.

Shell very dark, flame markings dark chocolate-brown and coalescing into two almost solid bands at the periphery, frequently the bands are hardly separated; below a band of the body-color with irregular flames in the umbilical region. Fully adult shells frequently lose most of the epidermis, but by transmitted light the two bands can be seen at the periphery with the lighter band and color below. Young, bright shells are generally very dark. Albinos are found on all of the islands. Ribs strong and running well down to the umbilicus, regular on the upper whorls, but less so on the body-whorl, being very irregular near the aperture. Body-whorl subcarinate, upper lip considerably flattened, particularly on the shells from Middle Sister Island, where it is frequently as much depressed as in *Circinaria*. Lip thickened in old shells and the parietal callus very heavy, frequently forming a strong ridge. Subscalariform specimens are not uncommon. Whorls six to six and one-half in Middle Sister shells, in those from other islands about five and one-half.

There appears to be a greater tendency to albinism on Middle Sister than on the other islands. Out of one hundred and seventy-six collected by the writer five immature shells are of a uniform straw-color and some of the adults, although badly weathered, seem by transmitted light to be albinos. Others are straw-colored with indistinct flames. Twenty-five to thirty shells, or about 16 per cent. are light-colored.

In the umbilicus of several of the Middle Sister shells the empty pupa-case of a fly, or wasp, was found filling the umbilicus completely and requiring a strong pull to detach it.

Middle Sister Island. 102 fully adult shells measured:

Diam. 21.81, Alt. 14.23 mm., Index,  $\frac{A}{D}$  65.25 average,

"	25.00,	"	17.50	"	"	70.00 largest,
"	19.50,	"	14.50	"	"	74.40 smallest,
"	23.00,	"	17.50	"	"	76.10 most elevated,
"	23.00,	"	13.50	"	"	58.70 most depressed.

Variation in diam. from 19.5 to 25.0 or 5.5 mm.

" " alt. " 12.5 " 17.5 " 5.0 "

Eighty-eight shells varied in diam. from 20.5 to 23.5 or 3 mm.

Ninety " " " alt. " 13.0 " 16.0 " 3 "

Green (Strontian) Island. 86 fully adult shells measured:

Diam.	19.3,	Alt.	12.6 mm.,	Index	66.33 average,
"	21.5,	"	13.0 "	"	60.47 largest,
"	17.0,	"	12.0 "	"	70.58 smallest,
"	18.0,	"	13.5 "	"	75.00 most elevated,
"	20.0,	"	11.0 "	"	55.00 most depressed.

Variation in diam. from 17.0 to 21.5 or 4.5 mm.

" " alt. " 11.0 " 14.0 " 3.0 "

Eighty-four shells varied in diam. from 17.5 to 21 or 3.5 mm.

Eighty-six " " " alt. " 11.0 " 14 " 3.0 "

North Harbor Island. Shells smaller. 41 varied from  $17.5 \times 11$  mm. to  $20.5 \times 12$  mm., average  $19.11 \times 12.01$  mm., index 62.65, the most elevated having an index of 71.05 and the most depressed of 57.50.

Type-locality Middle Sister Island, Lake Erie, Ontario. Types No. 7464 of my collection, paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

#### 5. *Polygyra profunda strontiana* var. nov.

Shell small, elevated, compact, dull-colored; umbilicus small, partly covered by the reflected lip, and contained about six times in the diameter of the shell. Whorls 5.

This variety was noticed by Binney, as in *Land and Fresh-water Shells of North America*, Pt. I, p. 153, in the table of specimens in the Binney and Bland Collection is the following reference: "No. 7946, 2 specimens, Strontian Id., Lake Erie, from W. G. Binney," and under Remarks, "Local var." In *Manual of American Land Shells*, p. 492, in the catalog of the Binney Collection, No. 39527 is from "Strontian Id., L. Erie, Collected by Hubbard, 6 spec., Var."

#### MEASUREMENTS.

*Green (Strontian) Island.*

Diam.	23.3,	Alt.	14.4 mm.,	Index,	$\frac{A}{D}$ 61.80 average of 103 shells,
"	25.5,	"	15.5 "	"	60.80 largest,
"	21.0,	"	13.5 "	"	64.80 smallest,
"	22.0,	"	15.0 "	"	68.18 most elevated,
"	24.5,	"	14.0 "	"	57.13 most depressed.

Variation in diam. from 21 to 25.5 or 4.5 mm.

" " alt. " 13 " 16.0 " 3.0 "

Ninety-eight shells vary in diam. from 22.0 to 25.0 or 3 mm.

Eighty-seven " " " " " 22.5 " 24.5 " 2 "

Ninety-four " " " alt. " 13.5 " 15.5 " 2 "

*North Harbor Island.*

Diam. 23.16, Alt. 14.56 mm., Index 62.87 average of 16 shells.

*Middle Sister Island.*

Diam. 24.05, Alt. 14.66 mm., Index 60.96 average of 129 shells,

" 27.00, " 16.50 " " 61.10 largest,

" 21.50, " 14.00 " " 65.10 smallest,

" 23.50, " 16.00 " " 68.08 most elevated,

" 25.50, " 14.00 " " 54.90 most depressed.

Variation in diam. from 21.5 to 27.0 or 5.5 mm.

" " alt. " 13.0 " 16.5 " 3.5 "

One hundred eighteen shells vary in diam. from 23 to 26 or 3 mm.

One hundred fourteen " " alt. " 14 " 16 " 2 "

Of the above 248 shells, 231 or 93.14 per cent. are from 21 to 25 mm. in diam. and 205, or 82.66 per cent., are under 25 mm. The average diam. is 23.5, alt. 14.54 mm., index 61.86.

Type-locality Green (formerly Strontian) Island, Lake Erie, Ohio. Types No. 7466 of my collection. Paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

On Put-in-Bay Island, the *profunda* are of the large, flatter, mainland form. They are also brighter in color.

Thirty-eight shells from four localities in Ohio, Illinois, and Ontario were measured, and gave an average of  $26.87 \times 15.1$  mm., index 56.10. Shells from farther south are much flatter, as the average of thirty-two shells from five localities in Kentucky, Virginia, and North Carolina is  $28.84 \times 14.82$  mm., index 51.4. The smallest of these thirty-two shells is  $25.5 \times 13.5$  mm. and the largest  $33 \times 16.5$  mm. The most depressed, excluding abnormal shells, had an index of 46.88 and the most elevated 55.77.

The specimens of *profunda* from Green Island appear to be losing the bands, as out of one hundred and three examined thirty-seven are banded, thirty-two are unicolorous and thirty-four are albinos. The bands are faint to obsolete and generally split, many of the unicolorous shells are so light that they might be called albinos. The large proportion of bandless shells, about 65 per cent., would seem to indicate the formation of a bandless race. On Middle Sister Island the proportion of bandless shells is smaller, as out of one hundred and thirty-four shells twenty-nine are of a uniform brown color, four are straw-colored, four are albinos, sixty-seven have a single brown band and thirty have two or more bands, the lower one usually split, and many

of them have the last season's growth, that is about one-half whorl back of the lip much lighter in color than the remainder of the shell.

#### 6. *Polygyra albolabris goodrichi* var. nov.

Shell elevated, heavy, dark chestnut-color, having a reddish cast when alive, lip brownish in immature shells and flesh-colored in adults. Whorls five and one-half. Compared with the average *albolabris* of the region the lip is narrower and less flattened, and the aperture is slightly more rounded and less oblique. One shell collected by Dr. Walker is dentate and one in my collection very faintly so. The color is so distinct and the shells so much more elevated than normal, that I consider it worthy of varietal rank and take pleasure in associating with it the name of Calvin Goodrich, of Toledo, Ohio, who has done much good work on the molluscan fauna of that most interesting island region.

Forty-eight fully adult shells were measured with the following result:

Diam.	28.24,	Alt.	19.44	mm.,	Index,	$\frac{A}{D}$	68.83	average,
"	30.00,	"	22.00	"	"	"	73.33	largest,
"	25.50,	"	17.00	"	"	"	66.67	smallest,
"	28.50,	"	22.50	"	"	"	78.95	most elevated,
"	26.00,	"	16.00	"	"	"	61.53	most depressed.

Variation in diam. from 25.5 to 30.0 or 4.5 mm.

" alt. " 16.0 " 22.5 " 6.5 "

Forty-five shells vary in diam. from 27.0 to 30.0 or 3.0 mm.

Forty-four " " alt. " 17.5 " 21.0 " 3.5 "

Type-locality Middle Sister Island, Lake Erie, Ontario. Types No. 7465 of my collection. Paratypes in the collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

Two or three dead shells found on North Harbor Island belong to this variety.

Walker in "Variation of *Polygyra albolabris* in Michigan," *Proc. Acad. Nat. Sci.*, 1910, pp. 21-40, gives the average size of one hundred and fifty-two shells from Cincinnati, O., as  $28.35 \times 18.78$  mm., index 66. Two hundred and twenty-five shells from various localities in Michigan, gave an average index of 67, and one hundred and twenty-four from Isle Royale, Michigan, an index of 65. I believe that a large series taken from almost anywhere in the interior region will show an average index of not over 66. A series from Bald Porcupine Island, Frenchmen's Bay, Maine, gave an index of about 64.

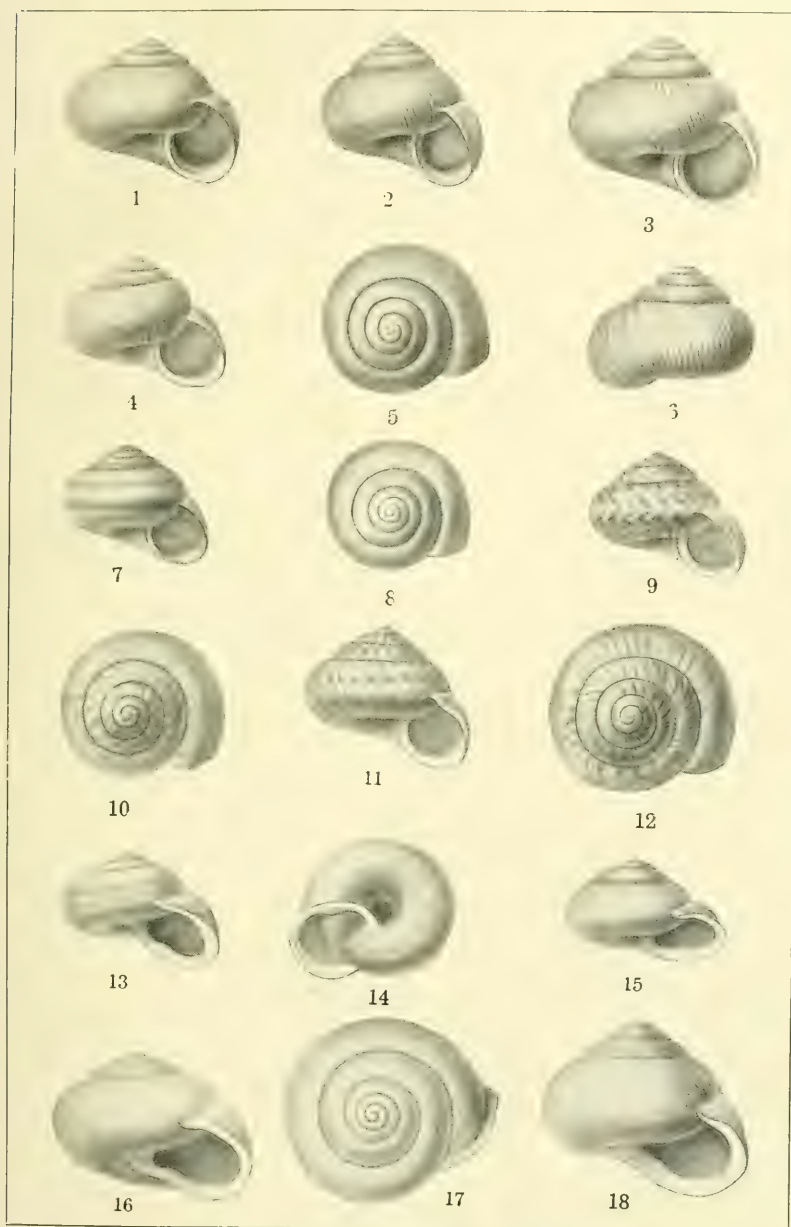


On the islands under cultivation, and particularly on West Sister Island, which was overrun by large flocks of turkeys, living mollusks were very scarce, while the dead shells indicated that at one time the molluscan population was very large, the ground being covered by the "bones." It is my belief that this destruction is largely due to the turkeys, which scratch up and eat the eggs. Of course the constant tramping of cattle and the destruction of the undergrowth by browsing would destroy large numbers, but the turkeys scratch all around, and even under the fallen trees, where the eggs would be deposited.

A number of dead shells were gathered on West Sister Island, and on cleaning out the dirt with which they were filled many minute species were found. Three of the dead specimens of *solitaria* contained young of from two to two and one-half whorls, there being two young in one of the shells and one in each of the others. Out of others broken young were shaken, but so badly broken that they were merely recognizable as the young of *solitaria*. Does this indicate that, at times, *solitaria* may be viviparous?

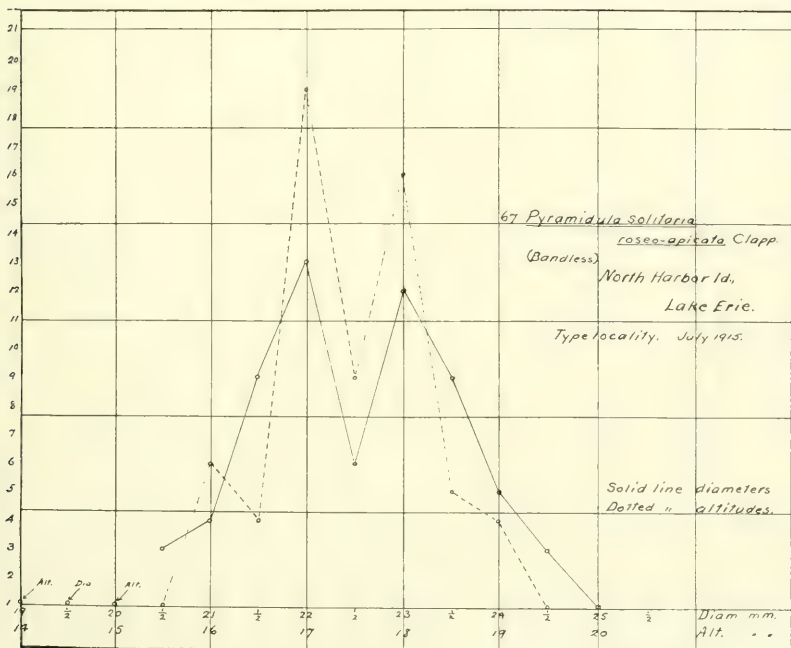
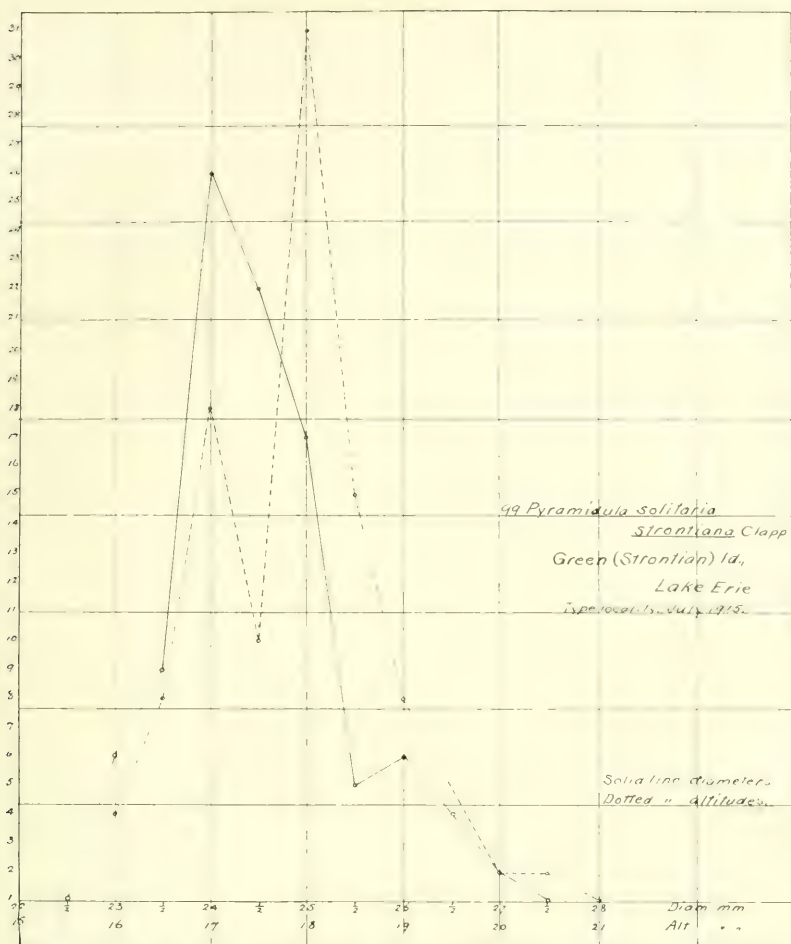
#### EXPLANATION OF PLATE XXXII.

- FIG. 1. *Pyramidula solitaria strontiana* Clapp. (Type)  
FIG. 2. *Pyramidula solitaria strontiana* Clapp, most elevated form.  
FIG. 3. *Pyramidula solitaria strontiana* Clapp, largest specimen.  
FIGS. 4-5. *Pyramidula solitaria roseo-apicata* Clapp. (Type)  
FIG. 6. *Pyramidula solitaria roseo-apicata* Clapp, back view.  
FIGS. 7-8. *Pyramidula solitaria mynesites* Clapp. (Type)  
FIGS. 9-10. *Pyramidula alternata eriensis* Clapp. (Type)  
FIG. 11. *Pyramidula alternata eriensis* Clapp, very tall specimen.  
FIG. 12. *Pyramidula alternata eriensis* Clapp, top view of largest specimen.  
FIGS. 13-14. *Polygyra profunda strontiana* Clapp. (Type)  
FIG. 15. *Polygyra profunda strontiana* Clapp, showing extreme elevation of spire.  
FIGS. 16-17. *Polygyra albolabris goodrichi* Clapp. (Type)  
FIG. 18. *Polygyra albolabris goodrichi* Clapp, showing extreme height of spire.



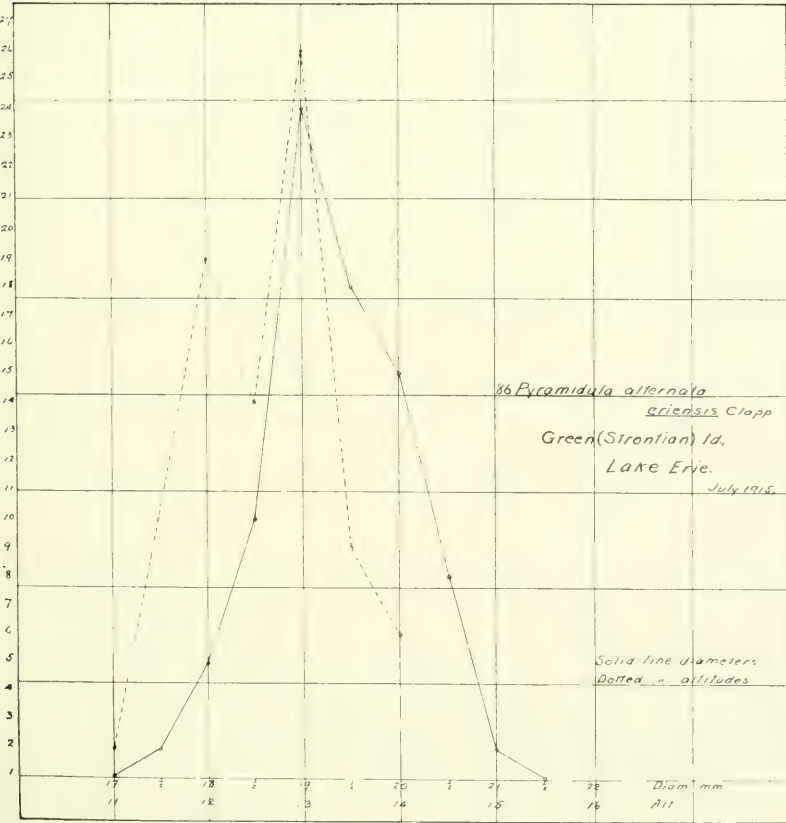
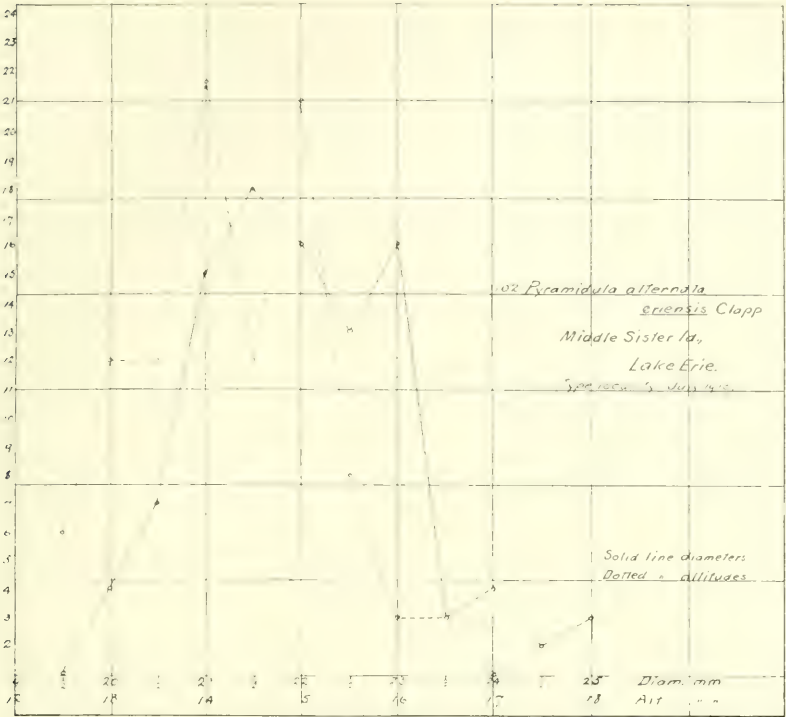
Shells from the Western Islands of Lake Erie.



Diagrams showing diameters and heights of *P. strontiana* and *P. roscio-apicata* Clapp.

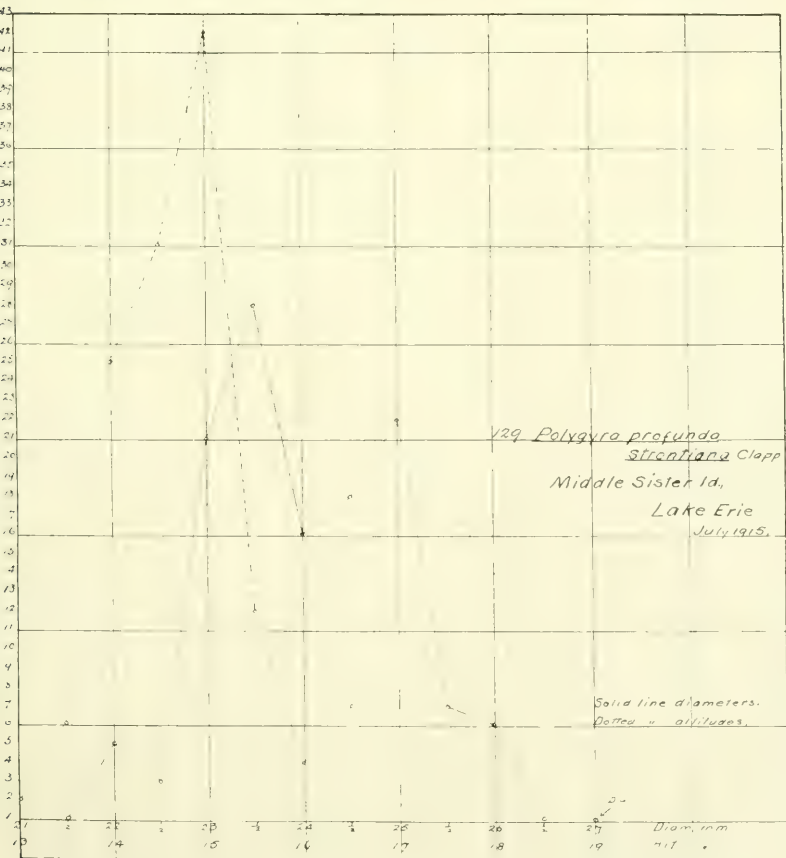
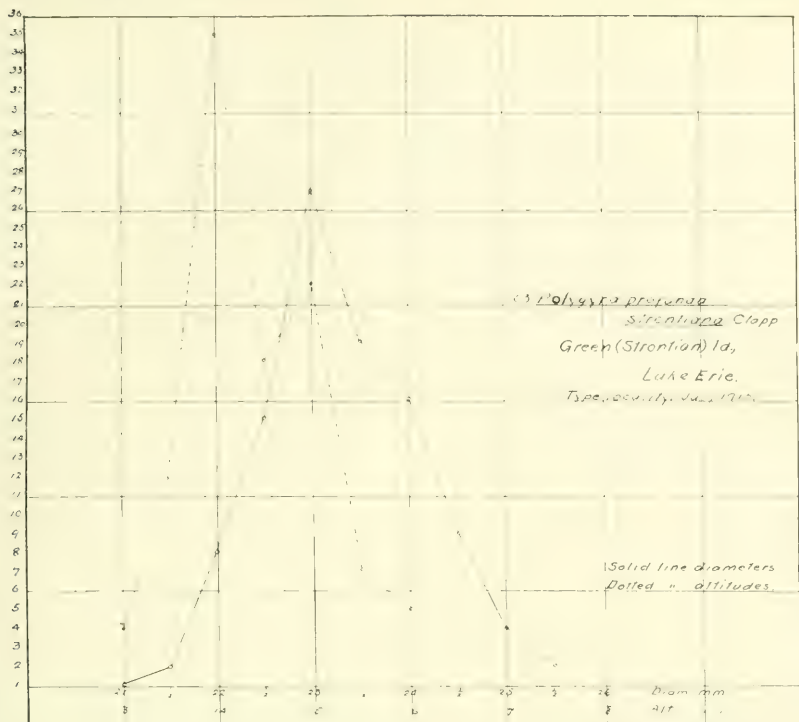






Diagrams showing diameters and heights of *Pyramidula alternata eriensis* Clapp.



Diagrams showing diameters and heights of *Polygyra profunda strombiana* Clapp.



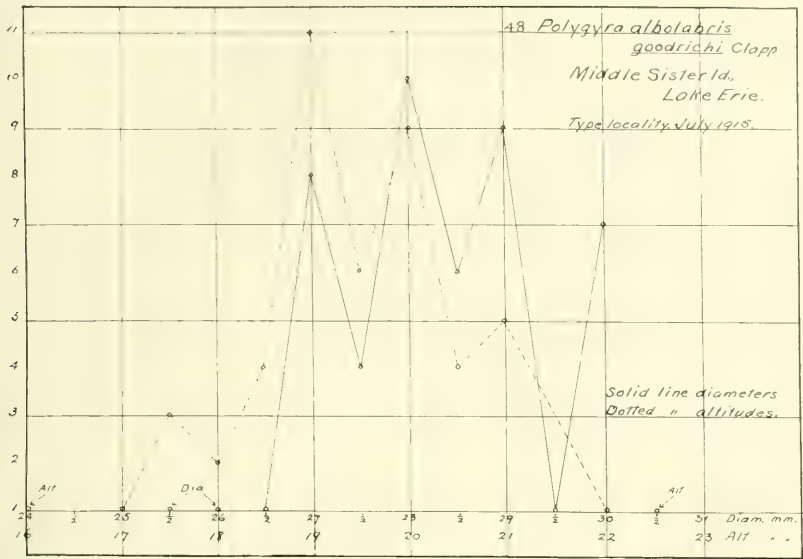


Diagram of diameters and heights of *Polygyra albolabris goodrichi* Clapp.



Mr. Bryant Walker collecting *Polygyra goodrichi* on Middle Sister Island, July 4, 1915.



Mr. George H. Clapp collecting shells on Middle Sister Island, July 4, 1915.





XXII. A LIST OF THE ORTHOPTERA COLLECTED IN  
THE ISLE OF PINES BY J. L. GRAF, 1910, AND  
G. A. LINK, 1912-1913.

BY W. J. HOLLAND AND HUGO KAHL.

In the preparation of the following brief list, so far as the Achetidæ and subsequent families are concerned, we have mostly made a compilation of the names of those species, which have been listed by Dr. Lawrence Bruner in his various papers upon the neotropical Orthoptera, which have from time to time appeared in these ANNALS. The list does not by any means cover the field, as Mr. Link only now and then picked up such specimens as he encountered. A diligent and systematic search by an orthopterist no doubt would show that a number of species, which have been reported from Cuba, but which are not here mentioned, are inhabitants of the island.

**BLATTOIDEA.**

Family BLATTIDÆ.

Genus BLATTA Linnæus.

**1. Blatta delicatula** Guérin-Ménéville.

*Blatta delicatula* GUÉRIN-MÉNÉVILLE, in SAGRA'S Hist. Nat. de Cuba, VII, 1857.  
p. 346.

A specimen taken by Link at Los Indios is referred to this species with a shadow of doubt. (*Det.* H. Kahl.)

Genus EURYCOTIS Stål.

**2. Eurycotis finschiana** (Saussure).

*Platyzosteria finschiana* SAUSSURE, Melanges Orthopt., II, Fasc. IV, 1872, p. 111.  
*Platyzosteria cabreræ* BOLÍVAR, An. Soc. Esp. Hist. Nat., X, 1881, p. 355, Pl. VIII,  
figs. 3, 3 a.

Two males and one female taken by Link at Los Indios, no date given. (*Det.* H. Kahl.)

## Genus PERIPLANETA Burmeister.

3. *Periplaneta americana* (Linnæus).

*Blatta americana* LINNÆUS, Syst. Nat., Ed. X, 1, 1758, p. 424.

A female from Los Indios, and another female from Nueva Gerona, the latter arriving at the Museum alive on July 25, 1912, and discovered when a box of bird-skins was being unpacked, thus illustrating the manner in which the insect has been transported from place to place in times past.

## Genus LEUCOPHÆA Burmeister.

4. *Leucophæa surinamensis* (Linnæus).

*Blatta surinamensis* LINNÆUS, Syst. Nat., Ed. X, I, 1758, p. 424.

One specimen from Los Indios.

## MANTOIDEA.

## Family MANTIDÆ.

## Genus GONATISTA Saussure.

5. *Gonatista grisea* (Fabricius).

*Mantis grisea* FABRICIUS, Ent. Syst., II, 1793, p. 22.

One male taken at Nueva Gerona, May 8, 1910.

## Genus MUSONIA Stål.

6. *Musonia cubensis* (Saussure).

*Thespis cubensis* SAUSSURE, Mitth. Schweiz. Ent. Gesellsch., III, 1869, p. 70.

Three specimens, a male and two nymphs, were taken at Nueva Gerona by Graf, May 6, 1910; a male was taken at Los Indios by Link in September, 1912. (*Det.* H. Kahl.)

## ACHETOIDEA.

## Family NEMOBIIDÆ.

## Genus NEMOBIUS Serville.

7. *Nemobius cubensis* Saussure.

*Nemobius cubensis* SAUSSURE, Miss. Mex., Orth., 8174, p. 384, Pl. VII, fig. 5.

One female taken at Los Indios.

## Family ACHETIDÆ.

## Genus GRYLLOUS Linnæus.

8. *Gryllus assimilis* Fabricius.*Gryllus assimilis* FABRICIUS, Syst. Ent., 1775, p. 280.

Nueva Gerona.

## Genus GRYLLODES Saussure.

9. *Grylloides sigillatus* (Walker).*Gryllus sigillatus* WALKER, Cat. Derm. Salt. B. M., I, 1869, p. 46.

A few specimens.

## Family PHALANGOPSITIDÆ.

## Genus AMPHIACUSTA Saussure.

10. *Amphiacusta annulipes* (Serville).*Phalangopsis annulipes* SERVILLE, Ann. Sci. Nat., XXII, 1831, p. 167.

Three specimens from Los Indios (Link coll.).

## TETTIGONOIDEA.

## Family PHANOPTERIDÆ.

## Genus MICROCENTRUM Scudder.

11. *Microcentrum marginellum* (Serville).*Phylloptera marginella* SERVILLE, Ins. Orthop., 1839, p. 405.

One female, Nueva Gerona, August 26, 1912.

## Genus DIPLOPHYLLUS Saussure.

12. *Diplophyllus insularis* Bruner.*Diplophyllus insularis* BRUNER, Ann. Carn. Museum, IX, 1915, p. 331.

The type, which is unique, was taken by Link in the month of June.

## Family CONOCEPHALIDÆ.

## Genus CONOCEPHALUS Thunberg.

13. *Conocephalus fasciatus* (DeGeer).*Locusta fasciata* DEGEER, Mémoir Ins., III., 1773, p. 458, Pl. XL, fig. 4.

Fourteen specimens taken at various localities during the months of July and August.

## Family COPIOPHORIDÆ.

## Genus NEOCONOCEPHALUS Karny.

14. *Neoconocephalus nigropunctatus* (Redtenbacher).

*Conocephalus nigropunctatus* REDTENBACHER, Verh. Zoöl.-Bot. Ges. Wien, XLI, 1891, pp. 380, 391, Pl. III, fig. 32.

One male taken at Nueva Gerona in March.

15. *Neoconocephalus maxillosus* (Fabricius).

*Locusta maxillosa* FABRICIUS, Syst. Ent., 1775, p. 284.

A single male captured at Nueva Gerona in July.

16. *Neoconocephalus muticus* (Redtenbacher).

*Conocephalus muticus* REDTENBACHER, l. c., p. 393.

Mr. Link captured a female of this species at Nueva Gerona in July.

## ACRIDOIDEA.

## Family TRUXALIDÆ.

## Genus ORPHULELLA Giglio-Tos.

17. *Orphulella scudderi* (Bolívar).

*Orphula scudderi* BOLÍVAR, Mém. Soc. Zoöl. France, I, 1888, p. 142.

Recorded from the Isle of Pines by Bruner (cf. ANN. CARN. MUSEUM, VIII, p. 17).

## Family ÆDIPODIDÆ (LOCUSTIDÆ).

## Genus PSINIDIA Stål.

18. *Psinidia fenestralis* (Serville).

*Ædipoda fenestralis* SERVILLE, Ins. Orthop., 1838, p. 726.

A very long series taken by Link at Nueva Gerona from the beginning of June to the end of August.

## Genus SPHINGONOTUS Fabricius.

19. *Sphingonotus haitensis* (Saussure).

*Ædipoda haitensis* SAUSSURE, Rev. Zoöl. (2), XIII, 1861, p. 323.

One specimen taken at Nueva Gerona by Graf, May 5, 1910.



## Family CYRTACANTHACRIDÆ.

## Genus SCHISTOCERCA Stål.

20. **Schistocerca pallens** (Thunberg).

*Gryllus pallens* THUNBERG, Mém. Acad. Petersb., V, 1815, p. 237.

A very long series taken at Nueva Gerona in June and July.

21. **Schistocerca inscripta** (Walker).

*Cyrtacanthacris inscripta* WALKER, Cat. Derm. Salt. B. M., III, 1870, p. 550.

Apparently very common. A long series taken by Link at Nueva Gerona in the months of June, July, and August.



## INDEX.

- abbreviata*, *Cyrtoxipha*, 408  
*abbreviatus*, *Gryllus*, 379  
*Scapteriscus*, 352  
 Abundance of snails on Middle Sister Island, Lake Erie, 528  
*Acanthophaelus melanzonus*, 132, 133, 134  
*accelerans*, *Geisonoceras*, 26  
*Accipiter gundlachi*, 161  
*striatus* *fringilloides*, 161  
*Achatina straminea*, 319  
*Acheta*, 377  
*bimaculata*, 378  
*nivea*, 397  
*Achetidae*, 347, 544  
     Synopsis of the South American genera of, 377  
*Achetoidea*, South American, 346, 543  
*Achyloides arcas*, 506  
*Acolastus amyntas*, 502  
*Acridoidea*, 545  
*Actinopteria æmiliana*, 26  
*boydi*, 26  
*Actitis macularia*, 160, 213  
*acuflavida*, *Sterna sandvicensis*, 160, 209  
*acuminata*, *Rhynchonella*, 29  
 Adams, Miss Jean, 312  
*Adelpha iphicla*, 493  
*adnexa*, *Æschna*, 523  
*adoxa*, *Ardea herodias*, 158, 178  
*Ægialitis vocifera*, 215  
*Ælurichthys pinnimaculatus*, 59  
*æmiliana*, *Actinopteria*, 26  
*æqualis*, *Micrathyrina*, 524  
*Æschna* (*Coryphæschna*) *virens*, 523  
*adnexa*, 523  
*affinis*, *Apareiodon*, 71, 74  
*Parodon*, 71, 74, 75  
*Salminus*, 91, 92  
*aflavida*, *Chæmepelia passerina*, 158, 222  
*Columbigallina passerina*, 222  
*Aganisthos odius*, 493  
*agarithe fornax*, *Catopsilia*, 497  
*agassizi*, *Scapteriscus*, 352  
*Agelaius assimilis*, 159, 273, 274  
*humeralis*, 161  
*phœniceus*, 273, 275  
*subniger*, 273, 274  
 Age of Mammals and Birds, 2  
     Reptiles, 2  
*aglæus*, *Quiscalus quiscalus*, 277  
*Agoniates anchovia*, 77, 78  
*Agrion capreolus*, 520  
*cardenium*, 520  
*hastatum*,  
*maria*, 521  
*capillare*, 521  
*Aix sponsa*, 161, 191  
*Ajala ajaja*, 158, 188  
*alba*, *Guara*, 158, 188  
*Ibis*, 188  
     -pinensis, *Lingula*, 25  
*albilora*, *Dendroica dominica*, 266  
*albina*, *Pyramidula solitaria*, 533  
*allipalpus*, *Hygronemobius*, 375, 376  
*albolabris goodrichi*, *Polygyra*, 539  
*albus*, *Eudocimus*, 188  
*Alcedo alcyon*, 239  
*alcyon*, *Alcedo*, 239  
     *Ceryle*, 239  
     *Streptoceryle alcyon*, 160, 239  
 Allen, John A., 529  
*alleni*, *Hygronemobius*, 375  
*alope*, *Erinnyis*, 511  
*Alsophis angulifer*, 305, 306  
*alternata eriensis*, *Pyramidula*, 535, 536  
*altus*, *Oligoplites*, 62  
*alutaceus*, *Anoiis*, 302  
*amates*, *Pœcilia*, 120  
     *Pœciliopsis*, 120  
*Amatidae*, 512  
*Amazona leucocephala*, 161, 228, 229  
     *palmarum*, 159, 161, 228  
*amazonica*, *Pœcilia*, 131  
*amazonus*, *Nemobius*, 373  
*Amblyopsidae*, 95  
*Amblyopsis spelæus*, 97  
*Amblyrhethus*, 417  
*Amblyscirtes folia*, 508  
     *insulæ-pinorum*, 508  
     *tutolia*, 508  
*Ambocelia gregaria*, 25, 38  
*Ambonychia curvata*, 335  
     *mytiloides*, 329  
*Ambonychidae*, 334  
*Ameiva auberi*, 304  
*amelia*, *Terias*, 499  
*americana*, *Curatella*, 150

- americanus, *Coccyzus*, 232  
     *Compsothlypis*, *usneæ*, 160, 270  
     *Crocodylus*, 299  
     *Cyrenella*, 322  
     *Fulica*, 160, 203  
     *Metioche*, 403  
     *Mycteria*, 158, 189  
     *Periplaneta*, 543  
     *Phæthon*, 161  
     *Platyclymenia*, 27, 29  
*Ammodramus savannarum australis*,  
     160, 285  
     subsp., 161  
*ammon*, *Lycæna*, 495  
*Ammonoidea*, 27  
*Amnicola coronata*, 322, 323  
*Amphiacusta*, 387  
     *annulipes*, 391, 395, 543  
     *grandis*, 391  
*Amphiacustes*, 391  
*amphipyroides*, *Latebraria*, 514  
*amplus*, *Crenipecten*, 26  
*Ampullaria reflexa*, 322, 323  
*Amusus*, 386  
*amygdalina*, *Leperditia*, 327  
*amyntas*, *Nennius*, 502  
*Amyris balsamifera*, 149  
*Anablepinæ*, 96  
*Anableps anableps*, 142  
     *microlepis*, 142  
*anætheta*, *Sterna*, 161  
*analís*, *Neomænis*, 65  
*Anaphora*, 517  
*Anaphoridæ*, 517  
*Anartia jatropha*, 492  
     *lytrea*, 492  
*anatum*, *Falco peregrinus*, 160, 195  
*Anaudus*, 417  
*Anaxipha*, 402  
     *pallens*, 409, 410  
     *pallida*, 408  
*Ancyloxypha nanus*, 506  
*Ancylus radiatilis*, 322, 323  
*anchovia*, *Agoniatés*, 77, 78  
*Ancistrus melas*, 83  
*andrea*, *Leimadophis*, 306  
*andræmon*, *Papilio*, 500  
*angasi*, *Proteides*, 502  
*angelina*, *Bathyrurus*, 327  
*anguiformis*, *Sphagebranchus*, 55, 56.  
*angulifer*, *Alsophis*, 305, 306  
     *Epicrates*, 304  
     *angusticeps*, *Anolis*, 302  
     *angusticollis*, *Cyrtoxipha*, 405  
*Anhinga anhinga*, 158, 171  
*Ani*, 149, 230  
     *Crotophaga*, 159, 229  
*Anisoptera*, 522  
*Annual Report of the Director*, 314  
*annulata*, *Clymenia*, 29  
*annulatus*, *Spheroides*, 69  
*annulicornis*, *Hapithus*, 423  
*annulipes*, *Amphiacusta*, 391, 395, 543  
*Anolis*, 297  
     *alutaceus*, 302  
     *angusticeps*,  
         *equestris*, 301  
         *homolechis*, 302  
         *porcatus*, 302  
         *sagrei*, 301  
*Anolis*, *Giant*, 301  
*Anomalagrion hastatum*, 520  
*Anona squamosa*, 151  
*Anosia berenice*, 488  
*Anous stolidus stolidus*, 161  
*antæus*, *Cocytius*, 510  
*anthracina*, *Urubitinga*, 193, 194  
*anthracinus*, *Falco*, 193  
*antillarum*, *Cryptoptilum*, 385  
     *Podilymbus podiceps*, 170  
     *Sterna*, 158, 209  
*antiqua*, *Conocardium*, 336  
     *Phemiades*, 509  
*Antrostomus carolinensis*, 160, 238  
     *cubanensis*, 238  
     *vociferus*, 238  
*Anurogryllus clarazianus*, 377  
*Apareiodon affinis*, 71, 74  
     *dariensis*, 71  
     *ecuadoriensis*, 71, 76  
     *itapicuruënsis*, 71, 72  
     *piracicabæ*, 71, 72  
     *terminalis*, 71  
*Apareiodon*, a new genus of Characid  
     *Fishes*. By Carl H. Eigenmann,  
         71-76  
         Key to the species of, 71  
*Apatosaurus*, 4  
     *louisæ*, 310  
*Aphonomorphus*, 417  
     *conspersus*, 424, 425  
     *diversus*, 425  
     *flavifrons*, 424  
     *griseus*, 425  
     *hapitheformis*, 425, 427  
     *lividus*, 425  
     *major*, 424, 425, 426  
     *mutus*, 424, 425  
     *obliquus*, 425, 426  
     *peruvianus*, 425  
     *silens*, 424, 425  
     *telskii*, 425  
     *testaceus*, 425  
     *timidus*, 424  
     *variegatus*, 424  
     *Synopsis of Tropical American*  
         *species of*, 424  
*apodus*, *Neomænis*, 64

- appressus, *Schizodus*, 26  
 approximans, *Polydactylus*, 61  
 aptera, *Cyrtoxipha*, 408  
 Aquatic Gastropods, directions for collecting, 478  
 aquaticus, *Nemobius*, 370  
 aquila, *Fregata*, 174  
 Arachnomimus, 387  
     *bahamaënsis*, 394  
 arachnopsis, *Endecous*, 392  
 Aramus *gaurauna*, 204  
     *giganteus holostictus*, 204  
     *vociferus*, 158, 204  
 Aratinga *euops*, 159, 228  
 Ara tricolor, 159, 227  
 aratus, *Neomænis*, 65  
 arborea, *Dendrocoryna*, 158, 190  
 arboreum, *Pithecolobium*, 152, 153  
 arcas, *Brachycorene*, 506  
 archiaci, *Spirifer*, 29  
 Archosargus *unimaculatus*, 66  
 Arctiadae, 512  
 arctiostriata, *Productella*, 25, 46  
 arctostriatus, *Productella*, 28  
 Ardea *candidissima*, 181  
     *egretta*, 179  
     *herodias adoxa*, 158, 178  
         *repens*, 178  
         *wardi*, 177  
     *leucogaster*, 181  
     *occidentalis occidentalis*, 177  
         *repens*, 158, 176, 177  
     *tricolor ruficollis*, 181  
     *virescens*, 182  
 Ardetta *exilis*, 175  
 Arenaria *interpres morinella*, 160, 217  
 argentarius, *Spirifer*, 31, 32  
 argentinus, *Ecanthus*, 396, 398  
     *Gryllodes*, 382, 384  
     *Gryllus*, 380  
 Argiallagma *minutum*, 519  
 argiventris, *Neomænis*, 65  
 Argizala *brasiliensis*, 371  
 argutula, *Sturnella*, 272  
 Argyria *auratella*, 517  
 Arixenia, 346  
 armatus, *Centropomus*, 64  
 asander, *Epargyreus*, 502  
 Asarcia, 220  
 Asbolis *sandarac*, 509  
 Ascalaphidae, 526  
 Ascalaphus *hyalinus*, 526  
 ascensionis, *Holocentrus*, 61  
 asiatica, *Melopelia asiatica*, 161  
 Asio *stygius*, 159, 235  
 aspera, *Atrypa*, 29  
 assimilis, *Agelaius*, 159, 273, 274  
     *Gryllus*, 379, 380, 544  
 astabulense, *Leiorhynchus*, 38, 39  
 Astyanax *magdalenæ*, 89  
     *stilbe*, 89  
 atala, *Eumæus*, 494  
 Atalopedes *cunaxa*, 507  
 Athyridæ, 43  
 atra, *Rhipipteryx*, 361  
 atratus, *Tridactylus*, 356, 357  
 Atremata, 25, 30  
 atricilla, *Larus*, 161  
 atrifrons, *Cyrtoxipha*, 405  
 atroviolacea, *Dives*, 276  
     *Ptiloxena*, 159, 276  
 atro-violaceus, *Quiscalus*, 276  
 Atrypa *aspera*, 29  
     *reticularia*, 29  
 auberi, *Ameiva*, 304  
 aura, *Cathartes aura*, 158, 191  
     *septentrionalis*, *Cathartes*, 192  
 auratella, *Argyria*, 517  
 aureolus, *Gerres*, 66  
 auricoma, *Pleurodonte*, 321  
 auripennis, *Libellula*, 523  
 auritus *floridanus*, *Phalacrocorax*, 158, 171  
 aurocapillus, *Seiurus*, 160, 264  
 australis, *Ammodramus savannarum*, 160, 285  
     *Tridactylus*, 356, 357  
 autumnalis, *Plegadis*, 161  
 Avicennia *nitida*, 151  
 Aviculopecten *celsus*, 26  
     *fasciculatus*, 26  
     *princeps*, 26  
 Avifauna, Isle of Pines list of, 158  
 bachmani, *Helminthophila*, 270  
     *Vermivora*, 270  
 Baggesen, F. F., 171  
 bahamaënsis, *Arachnomimus*, 394  
 bahamensis, *Lysiloma*, 153  
     *Pœcilonetta*, 161  
     *Saurothera*, 231  
 bairdii, *Campephilus*, 161  
 Balistes *nauffragium*, 68  
     *polylepis*, 68  
 Balistidæ, 68  
 balsamifera, *Amyris*, 149  
 Bangs, Outram, 147, 155, 170, 184  
 Banisteria *laurifolia*, 149  
 baracoa, *Limochores*, 507  
 barbatula, *Vireosylva calidris*, 159, 257  
 Barbour, Dr. Thomas, 184  
     The Reptiles and Amphibians of the Isle of Pines, 297-308  
 bardenflehti, *Polygyra*, 321  
 Barnes, R. M., 238  
 barrisi, *Meristella*, 25, 44  
 barytus, *Quiscalus*, 276  
 basalis, *Hygronemobius*, 374



- batabano, Phocides, 501  
 batesi, Brachymesia, 525  
 Bathyrus angelina, 327  
 beathiana, Pineria, 320  
 Beecher, Lucas, 527  
 beecheri, Conocardium, 329, 336  
 bella, Zenaidura macroura, 223  
 Benezet, Jean'Etienne, 311  
 berenice, Anosia, 488  
     Erythrodiplax, 524  
 Beyrichia? clavigera, 327  
     clavifracta, 327  
 Bibliography of birds of the Isle of  
     Pines, 286-296  
 bicolor, Tetrasygia, 152  
 bidorsata, Ctenodonta, 332  
 bimaculata, Acheta, 378  
     Iridio, 68  
 biolleyi, Rhipipteryx, 363  
 bipunctata, Neoxabea, 399, 400  
 Birds of the Isle of Pines. By W. E. C.  
     Todd, 146-296  
 Birds of North and Middle America,  
     147  
     (permanent residents and winter  
     visitants) of the Isle of Pines, 158  
     of western Cuba found in the Isle  
     of Pines,  
     of western Cuba not found in the  
     Isle of Pines, 161  
     of Venezuela, 4  
 Bishop, Dr. Louis B., 147  
 biternatus, Belinthus, 414  
 Bittern, 175  
     Least, 175, 176  
 bivittatus, Iridio, 68  
 Blacicus caribæus, 159, 250  
 Blackbird, Crow, 281  
     D'Orbigny's, 276  
     Red-winged, 274  
     Rusty, 276  
 Blackburnian Warbler, 267  
 blandus, Helmitheros, 262  
 Blastoidocrinus carchariædens, 326  
 Blatta americana, 543  
     delicatula, 542  
     surinamensis, 543  
 Blattoidea, 542  
 Blattaria, 345  
 blumenbachia, Euchasma, 336  
 Bobolink, 272  
 Bob-white, Cuban, 199  
 Boiids, 305  
 boisduvali, Urania, 515  
 boliviana, Luzara, 388  
     Rhipipteryx, 361, 364  
 boothiana, Thysanophora, 321  
 borealis, Neocurtilla, 350, 351  
 borellii, Luzara, 389  
 borellii, Scapteriscus, 352, 353  
 Botaurus lentiginosus, 159, 174  
 Boulenger, E. G., 105  
 boydi, Actinopteria, 26  
 borealis umbrinus, Buteo, 161  
 Brachiopoda, 25, 30  
 Brachycorene arcas, 506  
 Brachymesia batesi, 525  
 brachypterus, Holoquiscalus niger, 280  
 brachysomus, Calamus, 66  
 branicki, Pomadasis, 66  
 branneri, Pœcilia, 134  
 brasiliensis, Mugil, 61  
     Nemobius, 371  
     Œcanthus, 397  
 brevidens, Salminus, 91  
 brevipennis, Cylindrogryllus, 418  
     Miogryllus, 381  
 brevis, Palæoneilo, 26  
     Rivulus, 112  
 breviscula, Cyrtodonta, 329, 330, 341  
     Modiolopsis, 326  
 Brooks, Winthrop S., 297  
 brullei, Rhipipteryx, 362, 366  
 Bruner, Lawrence, South American  
     Crickets, Gryllotalpoidea, and Ache-  
     toidea, 344-428  
 brunescens, Butorides, 158, 182, 183,  
     185  
 Brya ebenus, 150  
 Bryozoa, 27  
     of the Chazy, 326  
 Buccinum fasciatum, 320  
 buceras, Bucida, 153  
 Bucida buceras, 153  
 Buddha, carving of, 311  
 Bufo empusus, 307  
     peltacephalus, 307  
 Bulimus poeyanus, 320  
 Bullfinch, Cuban, 154  
 Bunting, Indigo, 282  
 Busck, August, 487  
 Buteo borealis umbrinus, 161  
     platypterus cubanensis, 161, 193  
 Butorides brunescens, 158, 182, 183, 185  
     maculata, 182  
     saturatus, 185  
     virescens cubanus, 158  
 Buzzard, Turkey, 149  
 Byrsonima crassifolia, 150  
  
 caballus, Caranx, 62  
 cachinnans, Gallinula chloropus, 158,  
     203  
 Cacœcia, 517  
 cadma, Lucinia, 492  
 cærulea, Culicivora, 254  
     Dendroica, 267  
     Florida, 158

- cærulea*, *Polioptila*, 160, 254  
*cærulescens*, *Dendroica cærulescens*, 160, 268  
*Caiman*, 299  
*calabura*, *Muntingia*, 150  
*Calamus brachysomus*, 66  
*calidris*, *Vireosylva calidris*, 257  
*calidris barbatula*, *Vireosylva*, 159, 257  
*caliensis*, *Gambusia*, 95, 113  
*californiensis*, *Eucinostomus*, 67  
*Calisto herophile*, 494  
*Callidryas editha*, 498  
     *fornax*, 497  
     *godartiana*, 497  
     *neleis*, 497  
     *orbis*, 497  
*callosa*, *Eutrochatella*, 318  
*calypte helenæ*, 159, 246  
*Camarophoria (Leiorhynchus) subreniformis*, 29, 42  
*Camarotæchia contracta*, 25, 43  
     *metallica*, 25  
     *plena*, 338  
*camerani*, *Scapteriscus*, 352  
*Campephilus bairdii*, 161  
*canadensis*, *Grus*, 205, 206, 207, 208  
     *Leperditia*, 327  
     *Sowteria*, 326, 342  
*candidissima*, *Ardea*, 181  
     *Egretta*, 180, 181  
*caniceps*, *Geotrygon*, 161  
*Cannaphila insularis funerea*, 523  
*canora*, *Euethia*, 284  
     *Tiaris*, 159, 284, 285  
*cantans*, *Ectecous*, 390  
*capreola*, *Ceratura*, 520  
*Caprimulgus vociferus*, 238  
*Caracara*, Audubon's, 198, 231  
*Carangidæ*, 62  
*Caranx caballus*, 62  
     *hippos*, 62  
*carbonaria*, *Rhipipteryx*, 361  
*carchariædens*, *Blastoidocrinus*, 326  
*cardenium*, *Enallagma*, 520  
*Cardiolidæ*, 336  
*caribæa*, *Muscipeta*, 250  
     *Pinus*, 150  
*caribæus*, *Blacicus*, 159, 250  
     *Holoquiscalus caymanensis*, 159, 276, 277, 280  
*carinatus*, *Leiocephalus*, 303  
*carmioli*, *Vireo*, 256  
*Carnegie*, Andrew, 86  
*Carnegie Museum*, Visitors to, 314  
     Quarry near Jensen, Utah, 2  
*carnegiei*, *Cnesterodon*, 130  
     *Diplodocus*, 310  
     *Pseudancistrus*, 83  
*carolinensis*, *Antrostomus*, 160, 238  
*carolinensis*, *Columba*, 223  
     *Dumatella*, 160, 252  
     *marginata*, *Zenaidura*, 223  
     *Pandion haliaëtus*, 198  
     *Turdus*, 252  
*Carsidava cinerascens*, 421  
*carteri*, *Protambulyx strigilis*, 510  
     *Syringothyris*, 25, 27, 28  
*Casearia sylvestris*, 140  
*cassander*, *Telegonus*, 503, 504  
*castaneus*, *Discophogryllus*, 390  
*Catbird*, 252  
*Catharista uruba*, 191  
*Cathartes aura aura*, 158, 191  
     *septentrionalis*, 192  
*Catia misera*, 507  
*Catibo*, 306  
*Catopsilia agarithe fornax*, 497  
     *drya*, 497  
     *editha*, 498  
     *eubule*, 496  
     *neleis*, 497, 498  
*Catoptrophorus semipalmatus semipalmatus*, 160, 212  
*caudifasciatus*, *Pitangus*, 248  
     *Tolmarchus*, 159, 248  
*caucana*, *Girardinus*, 136  
     *Mollienisia*, 136, 137  
*caudomaculatus*, *Glaridodon*, 122, 123  
     *Phalloceros*, 94, 99, 100, 101, 102, 124, 127  
*cayennensis*, *Cyrtoxipha*, 404  
     *Sterna*, 209  
     *caymanensis Holoquiscalus*, 277, 280  
*caymanensis caribæus*, *Holoquiscalus*, 159, 276, 277, 280  
*celadon*, *Papilio*, 500  
*celæno*, *Macrothemis*, 526  
*Centropomidæ*, 63  
*Centropomus armatus*, 64  
     *ensiferus*, 64  
     *grandoculatus*, 63, 64  
     *medius*, 63, 64  
     *nigrescens*, 64  
     *parallelus*, 64  
     *pedimacula*, 63  
     *undecimalis*, 64  
     *viridis*, 64  
*Centurus superciliaris murceus*, 159, 161  
     *superciliaris*, 161  
*cephalus*, *Mugil*, 61  
*Cepolis comes*, 323  
     (*Cysticopsis*) *comes*, 321  
     (*Jeanneretia*) *multistriata pityonesica*, 321  
*Ceratura capreola*, 520  
*Cerchneis*, 197  
     *sparveria dominicensis*, 195

- cerdale, *Charcharhinus*, 58  
*Cerion pineria*, 320, 323  
*Ceryle alcyon*, 239  
*Cetopsorhamdia nasus*, 83  
*Chæmepelia passerina aflavida*, 158,  
 222  
*chalybea*, *Napata*, 512  
*chapadensis*, *Nemobius*, 372  
 Chapman, Frank M., 147  
*Characodontinae*, 96  
*Charadrius semipalmatus*, 60, 216  
*Charcharhinus cerdale*, 58  
*charithonius*, *Heliconius*, 488  
 Chazy in the Ottawa Valley, 326  
 of Quebec and the Mingan Islands,  
 327  
*Cheiloceras cephalopod zone*, 29  
*chemungensis*, var. *arctostriata*, *Hemi-*  
*pronites*, 45  
*Schuchertella*, 25, 45  
*Streptorhynchus*, 45  
*Macrodon*, 26  
*Mytilarca*, 26  
*Chen hyperborea nivalis*, 159, 191  
*cheriway*, *Polyborus*, 158, 198  
*chilensis*, *Curtilla*, 349  
 Chinese collections of Miss Jean Adams,  
 312  
*Chlorænas inornata*, 225  
*chloropus cachinnans*, *Gallinula*, 158,  
 203  
*chocoensis*, *Diphyacantha*, 95, 105, 114  
*Chondrohierax wilsonii*, 161  
*Chondropoma dissolutum*, 316, 323  
*wilcoxi*, 316  
 (var.), 323  
*Chordeiles virginianus minor*, 159, 237  
*virginianus*, 160, 236  
*chrysia*, *Geotrygon*, 158, 221  
*Chrysobalanus icaco*, 225  
*Chrysocantor petechia gundlachi*, 269  
*chrysocaulosus*, *Colaptes chrysocaulosus*,  
 161  
*Chrysopa*, 526  
*Chrysopidae*, 526  
*chrysurus*, *Ocyurus*, 65  
 Chuck-will's-widow, 238  
*cicindeloides*, *Thamnoscirtus*, 410  
*cinerascens*, *Carsidava*, 421  
*cinereus*, *Gerres*, 66  
*Sphærodactylus*, 301  
*cingulata*, *Herse*, 510  
*circumcincta*, *Rhipipteryx*, 361, 364  
*Circus hudsonius*, 160, 193  
*Citharichthys gilberti*, 70  
*citrea*, *Protonotaria*, 271  
*citrina*, *Terias*, 498  
*Tholyinis*, 526  
 Clapp, George H., Notes on the Land-  
 shells of the Islands at the Western  
 End of Lake Erie and descriptions of  
 New Varieties, 532-541.  
*claraziana*, *Neocurtilla*, 350, 351  
*clarazianus*, *Anurogryllus*, 377  
 Clark, B. Preston, collection of *Sphingi-*  
*dæ*, 311  
*clarkei*, *Leiorhynchus*, 43  
*Loxopteria*, 26  
*clathratum*, *Cyclostoma*, 316  
*Rhytidopoma rugulosum*, 316  
*clavifracta*, *Beyrichia?*, 327  
*clavigera*, *Beyrichia*, 327  
*Cleiothyridina*, 43  
*devonica*, 25, 43  
*sublamellosa*, 25  
*Clidophorus obscurus*, 332  
*Clionychia marginalis*, 334, 335  
*montrealensis*, 329, 334, 335  
*Clymenia annulata*, 29  
*flexuosa*, 29  
*Cnesterodon*, 129  
*carnegiei*, 130  
*decem-maculatus*, 94, 99, 100, 130  
*Cobalus tripunctus*, 508  
*Coccyzus americanus*, 232  
*erythrophthalmus*, 232  
*Cocothrinax Miraguana*, 149, 150  
*Cocytius antæus*, 510  
*cœnia*, *Junonia*, 492  
*Colænis delila*, 489, 490  
*julia cillene*, 489, 490  
*lucina*, 490  
*moderata*, 489  
*nudeola*, 489  
*titio*, 490  
*Colaptes chrysocaulosus chrysocaulosus*  
 161  
*superciliaris*, 241  
*Colinus cubanensis*, 158, 199  
*virginianus*, 199  
*collaris*, *Passerina*, 284  
 Collections of Reptiles and Amphibians  
 from the Isle of Pines, 297  
*collurides*, *Phylloscirtus*, 411  
*colombiana*, *Diatrypa*, 420  
*coloradensis*, *Productella*, 25, 45  
 var. *plicata*, *Productella*, 25, 46  
*Columba carolinensis*, 223  
*exsul*, 226  
*inornata*, 147  
*inornata*, 161  
*leucocephala*, 158, 224, 227  
*passerina*, 222  
*proxima*, 158, 225, 226  
*squamosa*, 158, 225, 227  
*columbarius*, *Falco*, 160, 195  
*Hypotriorchis*, 195  
*columella*, *Thecla*, 495

- colombiana, *Pœciliopsis*, 120  
 columbianus, *Heterandria*, 120  
 Columbigallina passerina aflavida, 222  
*Colymbus dominicus dominicus*, 158, 170  
 comes, *Cepolis*, 321  
*Composia fidelissima*, 514  
 compressus, *Rivulus*, 95, 111  
*Compsothlypis americana usneæ*, 160, 270  
 comptus, *Phylloscirtus*, 411  
*Conchylodes diphtheralis*, 516  
 Conklin, Professor E. G., 56  
 conklini, *Sphagebranchus*, 55, 56  
 connata fraterna, *Erythrodiplax*, 525  
*Conocardiidæ*, 336  
*Conocardium beecheri*, 329, 336  
   immaturum, 336  
   (*Pleurohynchus*) *antiqua*, 336  
*Conocephalidæ*, 544  
*Conocephalus*, 544  
   *fasciatus*, 544  
 conoideus, *Spirifer*, 29  
 conspersa, *Cyrtoxipha*, 406  
 conspersus, *Aphonomorphus*, 424, 425  
 constellata, *Priotrochella*, 317  
 contracta, *Camartœchia*, 25, 43  
   *Rhynchonella*, 43  
*Conularia*, 26  
*Conularida*, 26  
*Conurus euops*, 228  
   *guianensis*, 228  
 Coot, 203  
*Copæodes*, 506  
*Copernicia Curtisii*, 150  
*Cophus*, 387  
*Copiophoridæ*, 545  
*corculum*, *Protoneura*, 521  
*cordifera*, *Parra*, 219  
 Cormorants, Florida, 154, 171  
   Mexican, 172  
 coronata, *Amnicola*, 322  
   *Dendroica*, 160, 268  
 corrupta, *Prenes*, 509  
*Corvus jamaicensis*, 255  
   *minutus*, 161  
   *nasicus*, 159, 255  
 Cory, Charles B., 147  
*Corydoras metæ*, 78  
 Crane, Cuban, 150, 205  
 crassirostris, *Vireo*, 256  
 crebrisepalum, *Tornoceras*, 27  
 crenatus, *Stethaprion*, 77, 80, 81  
*Crenipecten amplus*, 26  
   *glaber*, 26  
 crenistria, *Schuchertella*, 25  
 Crickets (South American) *Gryllotal-*  
   *poidea*, and *Achetoidæ*. By Law-  
   rence Bruner, 344-428  
*Crocidophora zinghalis*, 516  
*Crocodylus americanus*, 299  
   *porosus*, 299  
   *rhombifer*, 299  
 croicensis, *Scarus*, 68  
*Crotophaga ani*, 159, 229, 230  
 Crow, Common, 255  
   Cuban, 154, 255  
 cruciana, *Dendroica petechia*, 269  
 cruciata, *Rhipipteryx*, 362, 365  
 cryptoleuca, *Progne*, 159, 260  
*Cryptoptilum antillarum*, 385  
*Ctenodonta bidorsata*, 332  
   *ubiaformis*, 331, 341  
   *levata*, 331  
   *nasuta*, 329, 330, 341  
   *parvidens*, 326, 330, 340  
*Ctenodontidæ*, 330  
*Ctenucha hilliana*, 512  
 Cuban Bullfinch, 154  
   Crow, 154  
   Ground Dove, 151, 218, 222  
   King Rail, 153  
   Macaw, 227  
   Martin, 259, 260  
   Meadowlark, 151, 233, 272  
   Mourning Dove, 151  
   Oriole, 151, 275  
   Petchary, 151, 248  
   Quail, 151  
   Red-wing, 153  
   Sparrow Hawk, 150  
   Tody, 149, 238  
   Wood Pewee, 152  
   Yellow Warbler, 151  
 cubanensis, *Anstroctomus*, 238  
   *Buteo platypterus*, 161, 193  
   *Colinus*, 199  
   *Setochealcis*, 159, 238  
 cubanus, *Butorides virescens*, 158, 183,  
   186  
   *Rallus longirostris*, 161  
 cubensis, *Dromicus*, 306  
   *Galba*, 321  
   *Leiocephalus*, 304  
   *Limia*, 137  
   *Musonia*, 543  
   *Nemobius*, 372, 543  
   *Physa*, 322  
   *Tyrannus*, 159, 247  
*Cuboides horizon*, 29  
 Cuckoo, Black-billed, 232  
   Isle of Pines Lizard, 149, 231  
   Yellow-billed, 232  
*Culicivora cærulea*, 254  
 cultriger, *Curtilla*, 349  
 culveri, *Trachinotus*, 62  
 cunaxa, *Atalopedes*, 507  
 cuneifolium, *Dendropanax*, 152

- Curatella americana*, 150  
*curema*, Mugil, 61  
*Curtilla*, 349  
     *chilensis*, 349  
     *cultriger*, 349  
     *gryllotalpa*, 349  
*Curtillidæ*, 348  
*Curtisii*, Copernicia, 150  
*curvata*, Ambonychia, 335  
*cuspidatus*, Spirifer, 25  
*cyanea*, Passerina, 160, 282  
*Cyanerpes cyaneus ramsdeni*, 161  
*cyaneus ramsdeni*, *Cyanerpes*, 161  
*cycanocephala*, *Starnænas*, 158, 220  
*cyanipennis*, *Rhipipteryx*, 362  
*Cyclostoma clathratum*, 316  
*Cyclura macleayi*, 303  
*Cydosia linki*, 513  
     *phædra*, 513  
*cylindraceus*, *Rivulus*, 108  
*Cylindrella pruinosa*, 320  
*cylindrica*, *Pthonia*, 26  
*Cylindrodidæ*, 348  
*Cylindrogryllus*, 416  
     *brevipennis*, 418  
*cynara*, *Macrodes*, 514  
*Cypricardella*, 26  
*Cypricardinia*, 6  
*Cyprinodontinæ*, 96  
*Cypseloides niger*, 244  
*Cyrenella americana*, 322, 323  
*Cyrtacanthacridæ*, 546  
*Cyrtacanthacris inscripta*, 545  
*Cyrtodonta breviscula*, 329, 330, 341  
     *lamellosa*, 330, 333  
     *scala*, 333  
     *solitaria*, 332  
     *subcarinata*, 329  
     *tranceps*, 337  
*Cyrtoxipha*, 402  
     *abbreviata*, 408  
     *angusticollis*, 405  
     *aptera*, 408  
     *atrifrons*, 405  
     *cayennensis*, 404  
     *conspersa*, 406  
     *gundlachi*, 403  
     *maxima*, 407  
     *nitida*, 404  
     *peruviana*, 405  
     *tibialis*, 405  
     *variegata*, 404  
  
 Daggett, Dr. Frank S., 1  
*dariensis*, *Apareiodon*, 71  
     *Parodon*, 76  
*decem-maculatus*, *Cnesterodon*, 94, 99,  
     100, 130  
     *Glaridichthys*, 130  
  
*decolor*, *Saurothera*, 159, 161, 231  
     *merlini*, 231  
*delicata*, *Gallinago*, 160, 210  
*delicatula*, *Blatta*, 542  
*Dendrocoryna arborea*, 158, 190  
*Dendroica blackburniæ*, 267  
     *cærulea*, 267  
     *cærulescens cærulescens*, 160, 268  
     *discolor*, 160, 265  
     *dominica*, 160, 266  
     *dominica albilora*, 266  
     *fusca*, 267  
     *maculosa*, 269  
     *magnolia*, 269  
     *palmarum*, 160, 264  
     *palmarum hypochrysea*, 264  
     *petechia cruciana*, 269  
     *petechia flaviceps*, 269  
     *petechia gundlachi*, 159, 269  
     *pityophila*, 161  
     *striata*, 160, 265  
     *tigrina*, 269  
     *virens*, 160, 267  
*Dendropanax cuneifolium*, 152  
*denticulatus*, *Ellipes*, 359  
*depressa*, *Productella*, 25, 46  
*Dermaptera*, 346  
*Devonian formations*, in America, 30  
*devonica*, *Cleiothyridina*, 25, 43  
*Diatrypa*, 416  
     *colombiana*, 420  
     *ornata*, 421  
     *tuberculata*, 421  
*Dichromanassa rufescens*, 158, 179  
*Dictyoptera*, 345  
*didactylus*, *Scapteriscus*, 352, 353  
*didyma*, *Micrathyria*, 524  
*dina*, *Terias*, 498  
*Dione vanillæ* var. *insularis*, 490, 491  
*Dioptidæ*, 514  
*diphtheralis*, *Conchylodes*, 516  
*Diphyacantha*, 113  
     *chocoënsis*, 95, 105, 114  
*Diplodocus carnegiei*, 310  
     skull of, 3  
*Diplophyllus insularis*, 544  
*Discina lodiensis*, 31  
*Discinidæ*, 31  
*discolor*, *Dendroica*, 160, 265  
*discoloratus*, *Ecanthus niveus*, 397  
*Discophogryllus castaneus*, 390  
     *onthophagus*, 390  
*discors*, *Querquedula*, 159, 190  
*disjunctus*, *Spirifer*, 29, 33, 34, 35, 36  
*disseverans*, *Mocis*, 514  
*dissimilis*, *Hygronemobius*, 375, 376  
*dissocians*, *Micrathyria*, 524  
*dissolutum*, *Chondropoma*, 316  
*diversus*, *Aphonomorphus*, 425



- Dives atrovioleacea*, 276  
*Dolichonyx oryzivorus*, 160, 272  
*dominica*, *Dendroica dominica*, 160, 266  
*dominicensis*, *Cerchneis sparveria*, 195  
     *Falco*, 196  
     *Oriolus*, 275  
     *Tyrannus dominicensis*, 159, 247  
     *Xantornus*, 275  
*dominicus*, *Colymbus dominicus*, 158, 170  
     *Nomonyx*, 161  
     *Pluvialis dominicus*, 214  
*domitia*, *Perithemis*, 523  
*dorantes*, *Eudamus*, 501  
*Dormitator latifrons*, 69  
     *maculatus*, 69  
*dormitor*, *Philypnus*, 69  
*dougalli*, *Sterna*, 161  
*Douglass*, Earl, 2, 13, 309  
*douglassi*, *Tornoceras*, 27  
*Dove*, Blue-headed Quail, 220  
     Cuban Ground, 151, 218, 222  
     Mourning, 151  
     Ruddy Quail, 221, 236  
     West Indian Mourning, 223  
     *Zenaida*, 222  
*Dowitcher*, 210  
*Dromicus cubensis*, 306  
*drya*, *Catopsilia*, 497  
*dubiaformis*, *Ctenodonta*, 331, 341  
*Duck*, Antillean Tree, 153, 190  
     Wood, 191  
*Dumetella carolinensis*, 160, 252  
*dunbarensis*, *Leiorhynchus*, 25, 38, 39  
*dunckeri*, *Phallostethus*, 96  
*DuPuy*, Herbert: collection of old silver-ware, 311  
     gift of Pullman Parlor Car, 5, 312  
*Dwight*, Dr. Jonathan, 147  
*Dyscophogryllus*, 387  
*Dythemis rufinervis*, 525  
  
*ebenus*, *Brya*, 150  
*Ectecous*, 386  
     *borellii*, 389  
     *cantans*, 390  
*ecuadoriensis*, *Apareiodon*, 71, 76  
     *Leporinus*, 88  
     *Parodon*, 76  
*editha*, *Catopsilia*, 498  
*Editorial Notes*, 1-6; 309-313  
*Edmondia philipi*, 26  
*Edriotrypa*, 27  
*Education*, International Jury (Panama-Pacific Exposition), 1  
*Egret*, Reddish, 179  
     Snowy, 180  
*Egretta candidissima*, 180, 181  
  
*Egretta thula thula*, 158, 180  
*egretta*, *Ardea*, 179  
     *Herodias*, 158  
*Eigenmann*, Dr. C. H., 5, 57, 93, 94, 95, 121  
     *Apareiodon*, a New Genus of Characid Fishes, 71-76  
     Description of a New Sphagbranchus from the Bahamas, 55-56  
     New and Rare Fishes from South American Rivers, 77-86  
     On the Species of *Salminus*, 91-92  
*Eigenmann*, C. H. and Arthur Henn, Description of Three New Species of Characid Fishes, 87-90  
*eigenmanni*, *Fitzroyia*, 140  
     *Jenynsia*, 140  
     *Phalloptychus*, 95, 121  
     *Siphostoma*, 60  
*elathea*, *Terias*, 499  
*elegans*, *Lebinthus*, 414  
     *Neoheterandria*, 95, 117, 118  
     *Rivulus*, 108, 109  
     *Sphaerodactylus*, 300  
     *Spirifer*, 32  
*elegantalis*, *Leucinodes*, 516  
*Eleotris picta*, 69  
*eleucha*, *Timetes*, 493  
*Eleutherodactylus ricordii*, 308  
*elisabeth*, *Myadestes*, 159, 252  
     *retrusus*, *Myiadestes*, 252  
*Ellipes*, 354  
     *denticulatus*, 359  
     *histrio*, 359, 360  
     *histrionicus*, 359  
     *minimus*, 359  
     Synopsis of the South American species of, 359  
*Ellis*, Max, 57  
*elongata*, *Eutrochatella*, 318  
*Emerald*, Ricord, 149, 152, 246  
*Emmelia pantherula*, 513  
*Empetrichthys*, 96  
*Empidonax flaviventris*, 250  
*empus*, *Bufo*, 307  
*Enallagma cardenium*, 520  
*Endacusta*, 387  
*Endecous*, 387  
     *arachnopsis*, 392  
     *ferruginosus*, 392  
*Endodesma tranceps*, 337  
*Eneoptera surinamensis*, 413  
     *velutina*, 419  
*Eneopteridæ*, 348, 413  
*ensiferus*, *Centropomus*, 64  
*Eopteria typica*, 336  
*Epargyreus asander*, 502  
     *maysi*, 501

- Ephemeridæ, swarming of, 527, 529  
 Epicrates angulifer, 304  
 Epinephelus maculosus, 64  
 episcopi, Priapichthys, 116  
 Epistor lugubris, 511  
 equestris, Anolis, 302  
 erectum, Glyptodesma, 26  
 Eresia frisia, 491  
 Ereunetes pusillus, 211  
 ergolis, Lauron, 514  
 eriensis, Pyramidula alternata, 535, 536  
 Erinnyis alope, 511  
 Erismatura jamaicensis, 161  
 Erythemis simplicicollis, 525  
     verbenata, 525  
     vesiculosa, 525  
 Erythrodiplax berenice næva, 524  
     connata fraterna, 525  
     connata justiniana, 524  
     ochracea, 524  
     umbrata, 525  
 erythrogastra, Hirundo, 160, 258  
 erythrophthalmus, Coccyzus, 232  
 erythrorhynchus, Pelecanus, 159, 174  
 Euchasma blumenbachia, 336  
 Eudamus dorantes, 501  
     proteus, 500  
     san antonio, 502  
     santiago, 500  
 Eudocimus albus, 188  
 Eucinostomus californiensis, 67  
     gula, 67  
     pseudogula, 67  
 Euetheia canora, 284  
 eufala, Lerodea, 508  
 Eugenia puniceifolia, 151  
 Eumæus atala, 494  
 Eunomia latenigra, 512  
 euops, Aratinga, 159, 228  
     Conurus, 228  
 Eupera, genus, 446; index of species, *cf.*  
     p. 475  
 Eupithecia, 515  
 Euplœinæ, 488  
 Euprepia venusta, 512  
 Euptoieta hegesia, 491  
 Eurycotis finschiana, 542  
 euterpe, Terias, 499  
 Eutrochatella (Artecallosa) callosa, 318,  
     323  
     elongata, 318, 323  
     (Ustronia) scopulorum, 318, 323  
 Evolution, influence of habitat in, 429  
 exanimis, Modiolopsis, 338, 339  
 exilis, Ardetta, 175  
     Ixobrychus, 158, 175  
 expansa, Pterotheca, 332  
     Whiteavsia, 337  
 exsul, Columba, 226  
 exsul, Gymnasio lawrencii, 159, 234  
 fabaformis, Modiolopsis, 329, 338  
 faba, Modiolopsis, 338  
 fadus, Sesia, 511  
 Falcicula, 402  
 Falco anthracinus, 193  
     columbarius, 160  
     columbarius columbarius, 195  
     dominicensis, 196  
     leucophrys, 196  
     peregrinus anatum, 160, 195  
     sparverioides, 158, 195, 196, 197  
     sparverius, 195, 196, 197  
     sparverius sparverioides, 196  
 fasciata, Heterandria, 116  
 fasciatus, Conocephalus, 544  
     Liguus, 320  
     Lyriopecten, 26  
     Trachinotus, 62  
 fasciolatus, Phallotorynus, 95, 126, 127,  
     128, 129  
 Fauna of the Upper Devonian in Mon-  
     tana, 13-54  
     Three Forks Formation, 24, 25  
     Lower Mississippian, 27  
 Faunal survey of the West Indies, 146  
 favonius, Thecla, 495  
 Felichthys panamensis, 59  
     pinnimaculatus, 59  
 fenestralis, Psinidia, 545  
 fernandina, Nesoceus, 161  
     Teretistris, 159, 262  
 ferruginea, Orthemis, 523  
 ferruginosus, Endecous, 392  
 festæ, Pœcilia, 118  
     Pseudopœcilia, 119  
 ficus, Pachylia, 511  
 fidelissima, Composia, 514  
 Field notes made in the Isle of Pines  
     by Gustav A. Link, 146  
 Figures representing the nobility and  
     peasantry of several European coun-  
     tries, 311  
 finschiana, Eurycotis, 542  
 Fisher, Carl G., 82  
 fisheri, Trachycorystes, 82  
 Fishes for aquaria, 94  
     Description of three New Species  
     of Characids. By C. H. Eigen-  
     mann & Arthur W. Henn, 87-90  
     of Japan in Carnegie Museum, 6  
     extensive collections of South  
     American in Carnegie Museum,  
     139  
     New and Rare from South Ameri-  
     can Rivers. By C. H. Eigen-  
     mann, 77-86

- Fishes, Various South American Pœciliidæ. By Arthur W. Henn, 93-142
- Fitzroyia eigenmanni*, 140
- lineata*, 139, 140, 142
- maculata*, 140, 141
- multidentata*, 140
- pygogramma*, 140, 142
- Key to the Species of, 139
- Fitzroyiinae*, 96
- Flamingo*, 189
- flavescens*, *Pantala*, 526
- flaviceps*, *Dendroica petechia*, 269
- flavifrons*, *Aphonomorphus*, 424
- Lanivireo*, 257
- flavipes*, *Totanus*, 160, 212
- flaviventris*, *Empidonax*, 250
- Porzana*, 161
- flexuosa*, *Clymenia*, 29
- florella*, *Syngamia*, 516
- Florida cærulea*, 158, 179
- Everglades*, 153
- floridanus*, *Phalacrocorax auritus*, 158, 171
- Flycatcher*, *La Sagra*, 150, 151, 249
- Yellow-bellied*, 250
- folia*, *Amblyscirtes*, 508
- follicularis*, *Oleacina*, 319
- forceps*, *Rhipipteryx*, 361, 363
- Forficulina*, 346
- formosa*, *Heterandria*, 99, 100, 103, 116, 118
- fornax*, *Catopsilia agarithe*, 497
- Fossil beds at Rancho la Brea*, 1
- Fossils of the Chazy*, 325
- fraterna*, *Erythrodiplax connata*, 525
- Rhipipteryx*, 363
- Fregata aquila*, 174
- magnificens*, 158, 174
- fria*, *Pseudopocilia*, 95, 105, 119
- friderici*, *Leporinus*, 89
- Fringilla savannarum*, 285
- fringilloides*, *Accipiter striatus*, 161
- frisia*, *Eresia*, 491
- Fulica americana*, 160, 203
- spinosa*, 218, 219
- fulva*, *Petrochelidon fulva*, 159, 259
- Fundulus*, 96
- furcata*, *Strix pratincola*, 235
- Tyto perlata*, 159, 235
- fusca*, *Dendroica*, 267
- fuscata*, *Sterna*, 161
- fuscularis*, *Pionea*.
- fuscus*, *Pelecanus*, 173
- gaimardianus*, *Mugil*, 61
- Galba cubensis*, 321, 323
- galeata*, *Gallinula*, 203
- Galeichthys simonsi*, 58
- Galeidæ*, 58
- Gallinago delicata*, 160, 210
- Gallinule*, *Florida*, 203
- Purple*, 153, 203
- Gallinula chloropus cachinnans*, 158, 203
- galeata*, 203
- Gambusia*, 112
- caliensis*, 95, 113
- gracilis*, 122
- holbrooki*, 99, 103
- Gastropoda*, 26
- gaurauna*, *Aramus*, 204
- Geisonoceros accelerans*, 26
- normale*, 26
- genoveva*, *Junonia*, 492
- Geometer*, 515
- Geometridæ*, 515
- geometroides*, *Melanchroia*, 515
- Geothlypis trichas ignota*, 261
- trichas*, 160, 261
- Geotrygon caniceps*, 161
- chrysis*, 158, 221
- martinica*, 221
- montana*, 221
- Geranium Robertsonianum*, 528
- geronæ*, *Telegonus*, 503
- Gerres aureolus*, 66
- cinereus*, 66
- lineatus*, 66
- olisthostomus*, 67
- patao*, 67
- rhombeus*, 66
- simillimus*, 66
- Gerridæ*, 66
- gilberti*, *Citharichthys*, 70
- Gilbertolus*, 79
- Gilmore*, Charles W., Description of a new species of Tortoise from the Jurassic of Utah, 7-12
- Girardinus caucana*, 136
- iheringi*, 122
- januarius*, 122
- uninotatus*, 122
- glaber*, *Crenipecten*, 26
- Glacial period of the Great Lakes*, 529
- Glandina follicularis*, 319
- Glaridichthys decem-maculatus*, 130
- (*Phalloptychus*) *januarius*, 94
- Glaridodon caudomaculatus*, 122, 123
- januarius*, 122
- Glaucidium siju siju*, 161
- vittatum*, 159, 161, 232, 233
- Glaucopsis mors*, 515
- glaucovirans*, *Jatropha*, 283
- glaucus*, *Trachinotus*, 62
- globulosa*, *Proserpina*, 318
- Glyphodes hyalinata*, 516
- Glyptodesma erectum*, 26
- Glyptops cœlatus*, 11

- Glyptops depressus*, 10, 11  
     *pervicax*, 11  
     *plicatulus*, 7, 8, 9, 10, 11  
     *utahensis*, 7, 8, 9, 10, 12  
*Gnatcatcher*, Blue-gray, 254  
*Gnathocharax steindachneri*, 79  
*Gobiidae*, 69  
*Gobius soporator*, 70  
*godmani*, *Rivulus*, 108  
*Gonatista grisea*, 543  
*Goniaphora hamiltonensis*, 26  
     *subrecta*, 26  
*Goniatites horizon*, 29  
     (*Manticoceras*) *intumescens*, 29  
*Goniloba corrupta*, 509  
*Gonioclymenia cephalopod zone*, 29  
*Goodrich*, Calvin, A Trip to Islands in  
     Lake Erie, 527-531  
*Goodrich*, Calvin, 532  
*goodrichi*, *Polygyra albolabris*, 539  
*gracilis*, *Gambusia*, 122  
*Grackle*, Isle of Pines, 150, 276  
*Grammysia subarcuata*, 26  
*grandiflora*, *Xylopia*, 152  
*grandis*, *Amphiacusta*, 391  
*grandisquamis*, *Upeneus*, 61  
*grandoculatus*, *Centropomus*, 63, 64  
*Grassquit*, Melodious, 284  
     Yellow-faced, 151, 283, 285  
*Grebe*, Pied-billed, 170  
     Saint Domingo, 170  
*Great Lakes*, metropolis of Nearctic  
     *Sphæriidae*, 430  
*greeneanum*, *Leiiorhynchus*, 41  
*gregaria*, *Ambocœlia*, 25, 38  
*Gressoria*, 345  
*Griffin*, Dr. L. E., Catalog of Reptiles, 5  
*griseus*, *Aphonormorphus*, 425  
     *Limnodromus griseus*, 160, 210  
     *Neomenis*, 64  
*Grus canadensis*, 205, 206, 207, 208  
     *mexicana nesiotes*, 158, 205, 206,  
         207, 208  
     *mexicana mexicana*, 206  
     *nesiotes*, 205  
     *poliophoca*, 205  
*Grylloblattaria*, 344  
*Grylloides*, 377  
     *argentinus*, 382, 384  
     *clarazianus*, 377  
     *laplatea*, 383, 384  
     *macropterus*, 382, 383  
     *parvipennis*, 382  
     *pusillus*, 381  
     *pocyi*, 382  
     *pustulipes*, 382  
     *sigillatus*, 382, 544  
*Gryllomorphidae*, 347, 384  
*Gryllotalpa azteca*, 351  
*Gryllotalpa didactyla*, 353  
     *hexadactyla*, 351  
     *mexicana*, 353  
     *oxydactyla*, 353  
     *tetradactyla*, 353  
*gryllotalpa*, *Curtilla*, 349  
*Gryllotalpoidea*, 345  
     Key for separating the families of  
         the suborder of, 348  
*Gryllus*, 377  
     *abbreviatus*, 379  
     *argentinus*, 380  
     *assimilis*, 379, 380, 544  
     *pallens*, 545  
     *pusillus*, 381  
*Guara alba*, 158, 188  
*Guasabálo*, 308  
*Guazuma Guazuma*, 149  
*guianensis*, *Conurus*, 228  
*gula*, *Eucinostomus*, 67  
*Gulapinnus*, 129  
*Gundlach*, Dr. John, 155  
*gundlachi*, *Accipiter*, 161  
     *Chrysocantor petechia*, 269  
     *Cyrtoxipha*, 403  
     *Dendroica petechia*, 159, 269  
     *Hypomorphus*, 192  
*gundlachii*, *Holoquiscalus jamaicensis*,  
     278, 280  
     *Quiscalus*, 276, 279  
     *Urubitinga*, 158, 193, 194  
     *Vireo*, 159, 193, 194, 255, 256  
*Gynacantha nervosa*, 522  
*Gymnasio lawrencii exsul*, 159, 234  
*Gymnelia xanthocera*, 512  
*Gymnolaux lawrencii*, 234  
*gymnostoma*, *Jacana*, 219  
     *Jacana spinosa*, 220  
     *Parra*, 219  
*Hesperia eufala*, 508  
     *mesogramma*, 507  
     *savignyi*, 502  
     *syrichtus*, 506  
*Hesperiidae*, 500  
*Hesperiinae*, 500  
*habana*, *Telegonus*, 503  
*Hæmatia phœnicealis*, 516  
*Hæmatopus palliatus*, 161  
*Hæmulidae*, 65  
*Hæmulon macrostomum*, 65  
     *parra*, 65  
     *plumieri*, 65  
     *sciurus*, 65  
     *scuderi*, 65  
*hahneli*, *Telegonus*, 503, 504  
*haitensis*, *Pheviades*, 510  
     *Sphingonotus*, 545  
*haliætus carolinensis*, *Pandion*, 198

- hanno, *Lycæna*, 495  
 hapitheformis, *Aphonomorphus*, 425, 427  
 Hapithus, 417, 427  
   annulicornis, 423  
 hamiltonensis, *Goniophora*, 26  
 Haplochilus hartii, 108  
 Haplomi, 95  
 hartii, *Haplochilus*, 108  
   *Rivulus*, 108  
 Haseman, John D., 57, 93, 117  
 hasemani, *Apareiodon*, 71, 75  
   *Heterandria*, 95, 116  
 hastatum, *Anomalagrion*, 520  
 Hatcher, Prof. J. B., 3  
 Hawk, Broad-winged, 193  
   Cuban Crab, 193  
   Cuban Sparrow, 195  
   Duck, 195  
   Marsh, 193  
   Pigeon, 195  
 Hay, Dr. O. P., 7  
 Haynes, W. P., The Fauna of the  
   Upper Devonian in Montana, 13-54  
 hegesia, *Euptoietia*, 491  
 Heinz, H. J., 312  
 helenæ, *Calypte*, 159, 246  
 Helerecous, 417  
 Helicina adspersa, 318, 323  
   *callosa*, 318  
   *constellata*, 317  
   *elongata*, 318  
   *marmorata*, 318  
   *ornata*, 318  
   *tenuilabris*, 318  
   *variegata*, 318  
 Heliconiinae, 488  
 Heliconius charithonius, 488  
 Heliconia pantherula, 513  
 Helicotoma whiteaviana, 326  
 Helix auricoma, 321  
   *boothiana*, 321  
   *comes*, 321  
   *paludosa*, 321  
   *pityonesica*, 321  
 Helminthophila bachmani, 270  
   *peregrina*, 270  
 Helmitheros blandus, 262  
   *vermivorus*, 271  
 Hemeroblemma pandrosa, 514  
 Hemiancistrus landoni, 83  
 Hemigryllus, 368  
   *kriechbaumeri*, 376  
 Hemimerina, 346  
 Hemiodus longiceps, 87  
   *microlepis*, 87  
   *paraguayæ*, 87  
 Hemiprocna zonaris pallidifrons, 245  
 Hemipronites chemungensis var. *arcto-*  
   *striata*, 45  
 Hemiramphidae, 60  
 Henderson, John B., A List of the Land  
   and Fresh-water Shells of the Isle  
   of Pines, 315-324  
 Henn, Arthur W., 5, 57  
   On Various South American Pœci-  
   liid Fishes, 93-142  
 Henshaw, Henry W., 148  
 Herodias egretta, 158  
 herodias adoxa, *Ardea*, 158, 178  
   *repens*, *Ardea*, 178  
   *wardi*, *Ardea*, 177  
 Heron, Black-crowned Night, 186  
   Cuban Brown, 185  
   Cuban Great White, 176  
   Cuban Green, 186  
   Little Blue, 182, 179  
   Yellow-crowned Night, 187  
 herophile, *Calisto*, 494  
 Herse cingulata, 510  
 Heterandria colombianus, 120  
   *fasciata*, 116  
   *formosa*, 99, 100, 103, 116, 118  
   *hasemani*, 95, 116  
 heteristia, *Pœcilia*, 134  
 Heterocera, 510  
 Heteropus, 355  
 hexadactyla, *Neocurtilla*, 350, 351  
 heydeni, *Ligypterus*, 414  
 hieroglyphica, *Noropsis*, 515  
 hilarii, *Salminus*, 91, 92  
 Himantopus mexicanus, 158, 210  
 Hippocampus punctulatus, 60  
 hippocrepis, *Sturnella*, 273  
   *Sturnella magna*, 159, 272  
 hippos, *Caranx*, 62  
 hirsuta, *Productella*, 25, 46  
 hirsutiformis, *Productella*, 25, 46  
 hirta, *Trichilia*, 149  
 Hirtella mollicoma, 151  
 Hirundo erythrogastra, 160, 258  
 histrio, *Ellipes*, 359, 360  
 histrionicus, *Ellipes*, 359  
 holbrookii, *Gambusia*, 99, 103  
 Holland, W. J., 7  
   Editor of Carnegie Museum publi-  
   cations, 95  
   Interest in collections of South  
   American fishes, 139  
   Lepidoptera of the Isle of Pines,  
   487-518  
   Member of International Jury in  
   Department of Education, Pana-  
   ma-Pacific Exposition, 1  
   Silver tea-pot (antique) loaned by,  
   311  
   and Hugo Kahl, A List of the



- Orthoptera collected in the Isle  
of Pines, 542-545
- hollandi*, Limia, 95, 137, 138
- holmiae*, Rivulus, 110
- Holocentridæ, 61
- Holocentrus ascensionis*, 61
- Holoquiscalus caymanensis caribæus*,  
159, 276, 277, 280  
caymanensis, 277, 280  
gundlachi, 278  
jamaicensis gundlachi, 280  
jamaicensis, 280  
niger brachypterus, 280  
niger, 280
- holostictus*, Aramus giganteus, 204
- holzapfeli*, Loxopteria, 26
- homolechis*, Anolis, 302
- Hubbard, G. E., 30
- hubbardi*, Lingula, 29, 30
- Hudson, George H., publications of,  
325, 326
- hudsonius*, Circus, 160, 192
- humeralis*, Agelaius, 161
- Hummingbird, Helena, 154, 246  
Ricord, 239
- hyalinata*, Glyphodes, 516
- hyalinus*, Ululodes, 526
- Hydranassa tricolor ruficollis*, 158, 181  
rufimentum, 181
- hydrodroma*, Rhipipteryx, 361
- Hygronemobius*, 368  
albipalpus, 375, 376  
alleni, 375  
basalis, 374  
dissimilis, 375, 376  
liura, 375  
minutipennis, 375  
Synopsis of the species of, 374
- Hyla septentrionalis*, 307
- Hylephila phylæus*, 507
- Hylocichla ustulata swainsoni*, 254
- Hypena*, 514
- hyperborea nivalis*, Chen, 159, 191
- hypochrysea*, Dendroica palmarum, 264
- hypomelas*, Icterus, 159, 275
- Hypomorphus gundlachi*, 193
- Hyporhamphus roberti*, 60
- Hypotriorchis columbarius*, 195
- Ibis alba*, 188
- Ibis*, White, 153, 188  
Wood, 189
- Icterus hypomelas*, 159, 275
- idas*, Proteides, 502
- ide*, Siderone, 493
- ignota*, Geothlypis trichas, 261
- Ihering, Dr. H. von, 122
- iheringi*, Girardinus, 122
- ilaire*, Tachyris, 496
- imbecilis*, Pterinopecten, 26
- immaculatus*, Ecanthus, 396, 397
- immaturum*, Conocardium, 336
- Imparfinis microps*, 82
- inflata*, Schuchertella, 25, 28
- inoptatus*, Limnopardalus maculatus, 161
- inornata*, Chlorænas, 225  
Columba, 147, 161  
Columba proxima, 158
- inscripta*, Schistocerca, 545
- insulæ-pinorum*, Amblyscirtes, 508
- Tretanorhinus*, 306
- Xiphidiopicus percussus*, 159, 161
- insularis*, Diplophyllus, 544  
funerea, Cannaphila, 523  
Tramea, 526
- insularum*, Polygyra, 321
- intermedia*, Isochilina ottawa, 327  
Neocurtilla, 350
- interpres morinella*, Arenaria, 160, 217
- intumescens*, Goniates, 29
- Ionornis martinica*, 158, 203
- iphica*, Adelpha, 493
- Iridio bimaculata*, 68  
bivittatus, 68
- Islands of Lake Erie:  
East Sister, 529  
Green, 527  
Hen, 529  
Middle, 528  
Middle Sister, 528  
North Harbor, 528  
Strontian, 527  
West Sister, 527
- Isle of Pines area, 145  
bibliography referring to birds  
of, 286-296  
birds (migratory), 159  
birds (transient visitors), 160  
Carnegie Museum Expedition,  
1912-13, 156  
climate, 154  
collections of reptiles and  
amphibians, 297  
coral formation, 297  
expeditions, 155  
Geography and physiography,  
148  
jungle, 151, 152  
list of species of birds, 169-285  
marsh, 153  
population, 148  
rivers, 151
- Isochilina labellosa*, 327  
ottawa intermedia, 327
- Isoptera, 345
- itapicuruënsis*, Apareiodon, 71, 72
- Ivories, H. J. Heinz collection of, 310
- Ixobrychus exilis exilis*, 158, 175

- Jacana gymnostoma*, 219  
     "melanopygia", 220  
     *nigra*, 218  
     *spinosa gymnostoma*, 220  
         *spinosa*, 220  
         *violacea*, 153, 158, 217  
*jamaicensis*, *Corvus*, 255  
     *Erismatura*, 161  
     *Holoquiscalus jamaicensis*, 280  
     *gundlachii*, *Holoquiscalus*, 278, 280  
     *Melanthes otreus*, 505  
     *Pheviades*, 510  
*januarius*, *Girardinus*, 122  
     *Glaridichthys*, 94  
     *Glaridodon*, 122  
     *Phalloptychus*, 121, 122, 126  
     *Pœcilia*, 122  
*Jatropha glaucovirens*, 283  
*jatrophae*, *Anartia*, 492  
*jeffersonense*, *Leiorhynchus*, 25, 41  
*jenkinsi*, *Synodus*, 59  
*Jennings*, Dr. Otto E., 148  
     and Mrs. O. E., botanical  
         collections of, 4  
*Jenynsia eigenmanni*, 140  
     *lineata*, 139, 140  
     *maculata*, 141  
     *multidentata*, 140  
     *pygogramma*, 142  
*Jenynsiinae*, 96  
*Jordan*, Dr. and Mrs. David Starr, 1  
     "jubitos," 305  
     "jucaro" tree, 281  
*julia*, *Colænis*, 489, 490  
     *delila*, *Colænis*, 489  
     *julia*, *Colænis*, 490  
     *titio*, *Colænis*, 490  
*Junonia coenia*, 492  
     *genoveva*, 492  
  
*Kahl*, Hugo, A List of the Odonata  
     collected on the Isle of Pines by  
     Mr. J. L. Graf in 1910, and by  
     Mr. G. A. Link in 1912-1913,  
     now Contained in the Carnegie  
     Museum, 519-526  
     and W. J. Holland (See Holland,  
         W. J.), 542, 545  
*Keenan*, Miss Sophie G., 148  
*kelloggi*, *Leiorhynchus*, 39, 40  
*kessleri*, *Netuma*, 59  
*Khan*, Mirza Ali Kuli, 313  
*Killdeer*, West Indian, 215  
*Kindle*, E. M., 24  
*Kingbird*, Giant, 247  
     Gray, 150, 151, 247  
*Kingfisher*, Belted, 239  
*Kite*, Everglade, 192  
*Klages*, Samuel M., 4  
  
*Knight*, Wilbur C., 2  
*kriechbaumeri*, *Hemigryllus*, 376  
  
*labellosa*, *Isochilina*, 327  
*Labridæ*, 68  
*labruscæ*, *Pholus*, 511  
*Lævigata cephalopod zone*, 29  
*Lagoon*, Santa Rosalia, 152  
*Lake Erie*, A Trip to Islands in, By  
     Calvin Goodrich, 527-531  
*lamellosa*, *Cyrtodonta*, 330, 333  
*laminata*, *Productella*, 25, 46  
*Landon*, Hugh McK., 57, 83  
*Landon-Fisher Expedition to South  
 America*, 93  
*landoni*, *Hemiancistrus*, 83  
*Langley*, Prof. Samuel P., 313  
*Lanivireo flavifrons*, 257  
*Lantern-flies of the tropics*, 313  
*laplatæ*, *Grylloides*, 383, 384  
*Laranda*, 386  
     *tibialis*, 387, 388  
*Larus atricilla*, 161  
*Latebraria amphipyroides*, 514  
*latenigra*, *Eunomia*, 512  
*latifrons*, *Dormitator*, 69  
*latipinna*, *Mollienisia*, 98, 135  
*laura*, *Leiorhynchus*, 25, 43  
*Laurepa*, 417  
*laurifolia*, *Banisteria*, 149  
*lawrencii exsul*, *Gymnasic*, 159, 234  
     *Gymnoglaux*, 234  
*Lauron ergolis*, 514  
*leana*, *Lingula*, 25  
*Lebinthus bitæniatus*, 414  
     *elegans*, 414  
*Lebistes reticulatus*, 95, 105, 134, 135  
*Leda*, 26  
*Ledidæ*, 332  
*Leimadophis andreae*, 306  
     *nebulatus*, 305, 306  
*Leiocephalus carinatus*, 303  
     *cubensis*, 304  
     *vittatus*, 304  
*Leiorhynchus*, 29  
     *astabulense*, 38, 39  
     *clarkei*, 43  
     *dunbarensis*, 25, 38, 39  
     *greeneanum*, 41  
     *jeffersonense*, 25, 41  
     *kelloggi*, 39, 40  
     *laura*, 25, 43  
     *madisonense*, 25, 39, 40  
         var. *gibbosum*, 25, 39  
     *mesacostale*, 25, 39, 40, 42  
     *multicosta*, 43  
     *utahense*, 41  
         var. *ventricosum*, 25, 40, 42  
*lentiginosus*, *Botaurus*, 159, 175

- Leperditia amygdalina*, 327  
     *canadensis*, 327  
*lepidophylla*, *Tabebuia*, 150  
*Lepidoptera* (The) of the Isle of Pines,  
     being a List of the Species collected  
     on the island by Mr. J. L. Graf and  
     Mr. G. A. Link, in 1910 and 1912-  
     1913. By W. J. Holland, 487-518  
*Lepidoptera* of Arizona, 5  
*Leporinus ecuadoriensis*, 88  
     *friderici*, 89  
*Lepthemis vesiculosa*, 525  
*Leptodesma sociale*, 26  
*Lerneca*, 386  
*Lerodea eufala*, 508  
     *tripuncta*, 508  
*Lestes tenuatus*, 519  
*Leucinodes elegantalis*, 516  
*leucocephala*, *Amazona*, 229  
     *Amazona leucocephala*, 161, 228  
     *Columba*, 158, 224, 227  
     *inornata*, *Columba*, 158, 224, 227  
     *palmarum*, *Amazona*, 159, 161, 228  
*leucocephalus*, *Psittacus*, 228  
*leucogaster*, *Ardea*, 181  
*leucogastra*, *Sula*, 161  
*leucophæus*, *Rallus longirostris*, 158,  
     161, 201  
*leucophrys*, *Falco*, 196  
*leucorhynchus*, *Rhinobatus*, 58  
*levata*, *Ctenodonta*, 331  
*Libellula auripennis*, 523  
     *domitia*, 523  
*Liguus fasciatus*, 320, 323  
*Ligypterus heydeni*, 414  
*limbata*, *Rhipipteryx*, 361  
     *Vanuxemia*, 333  
*Limia*, 100  
     *cubensis*, 137  
     *hollandi*, 95, 137, 138  
*Limnæa cubensis*, 321  
*Limnodromus griseus griseus*, 160, 210  
*Limnopardalus maculatus inoptatus*,  
     161  
*Limochores baracoa*, 507  
*Limpkin*, 153, 204  
*lineata*, *Fitzroyia*, 139, 140, 142  
     *Jenynsia*, 139, 140  
*lineatipes*, *Tafalisca*, 415  
*lineatus*, *Gerres*, 66  
*lineolatus*, *Æcanthus*, 396, 398  
*Lingula alba-pinensis*, 25  
     *leana*, 25  
     *hubbardi*, 25, 30  
*Lingulacea*, 30  
*lingulata*, *Polygyra*, 321  
*Lingulidæ*, 30  
*Link, Gustav A.*, 146, 152, 153, 156,  
     157, 171, 178, 198, 202, 297  
*Link, John*, 156  
*linki*, *Cydosia*, 513  
*Lipotigris diphtheralis*, 516  
*lisa*, *Terias euterpe*, 499  
*liura*, *Hygronemobius*, 375  
*lividus*, *Aphonomorphus*, 425  
*loculator*, *Tantalus*, 189  
*Locustidæ*, 545  
*Locustoidea*, 345  
*lodiensis*, *Discina*, 31  
     *Orbiculoidea*, 25, 31  
*logani*, *Primitia*, 327  
*longiceps*, *Hemiodus*, 87  
*longipennis*, *Nemobius*, 370  
*longirostris cubanus*, *Rallus*, 161  
     *leucophæus*, *Rallus*, 158, 161, 201  
     *Waynei*, *Rallus*, 202  
*louisæ*, *Apatosaurus*, 310  
*Loxopteria clarkei*, 26  
     *holzapfeli*, 26  
*lucidus*, *Planorbis*, 322  
*lucina*, *Colænis*, 490  
*Lucinia cadma*, 492  
*lugubris*, *Epistor*, 511  
*lurida*, *Tafalisca*, 416  
*Lutianidæ*, 64  
*Luzara*, 386  
     *boliviana*, 388  
     *borellii*, 389  
     *rufipennis*, 388  
*Lycæna ammon*, 495  
     *hanno*, 495  
     *theonus*, 495  
*Lycænidæ*, 494  
*Lyriopecten fasciatus*, 26  
     *polydorus*, 26  
     *solox*, 26  
*Lysiloma bahamensis*, 153  
*lytrea*, *Anartia*, 492  
  
*Macaw*, *Cuban*, 227  
*macilenta*, *Neocurtilla*, 349  
*macleayi*, *Cyclura*, 303  
*macracanthus*, *Pomadasis*, 66  
*Macrodes cynara*, 514  
*Macrodon chemungensis*, 26  
*macropterus*, *Gryllodes*, 382, 383  
*macrosternum*, *Hæmulon*, 65  
*Macrothemis celæno*, 526  
*macroura bella*, *Zenaidura*, 223  
     *marginata*, *Zenaidura*, 223  
     *Zenaidura*, 158, 223  
*macularia*, *Actitis*, 160, 213  
*maculata*, *Butorides maculata*, 182  
     *Fitzroyia*, 140, 141  
*maculatus*, *Dormitator*, 69  
     *Philypnus*, 69  
     *inoptatus*, *Limnopardalus*, 161  
*maculosa*, *Dendroica*, 269

- maculosus, *Epinephelus*, 64  
 madisonense, *Leiornhynchus*, 25, 39, 40  
     var. *gibbosum*, *Leiornhynchus*, 25,  
     39  
 magdalenæ, *Astyanax*, 89  
     *Rivulus*, 95, 109  
 magnificens, *Fregata*, 158, 174  
 magnificum, *Symphyloxiphus*, 410  
 magnirostris, *Tyrannus*, 247  
 magnolia, *Dendroica*, 269  
 mahogoni, *Neomænis*, 65  
 Maja de Santa Maria, 304  
 "majagua," 150  
 "majasitas," 305  
 major, *Aphonomorphus*, 424, 425, 426  
     *Nemobius*, 371  
 Mal Pais Gravel, 150  
 mangle, *Rhizophora*, 151  
 Mangrove-swamp, 151  
 mani, *Megalomastoma*, 315  
 Man-o'-war Birds, 154, 174  
 Mantaria, 345  
 Manticoceras cephalopod zone, 29  
 Mantidæ, 543  
 Mantoidea, 543  
 marginalis, *Clionychia*, 334, 335  
 marginata, *Rhipipteryx*, 362  
     *Zenaidura carolinensis*, 223  
     *Zenaidura macroura*, 223  
 marginellum, *Microcentrum*, 544  
 marginipennis, *Rhipipteryx*, 363, 367  
 maria, *Neoneura*, 521  
 Marine (Some) Fishes from Colombia  
     and Ecuador. By Charles Wilson,  
     57-70  
 Marissa latenigra, 512  
 marmorata, *Helicina*, 318  
 marmoratus, *Phalangopsis*, 393  
 Marpesia eleucha, 493  
 Marsh, Othniel Charles, 2  
 martialis, *Thecla*, 495  
 Martin, Cuban, 259, 260  
 martinica, *Geotrygon*, 221  
     *Ionornis*, 158, 203  
 Maryland Yellow-throat, 261  
 Mawson, Sir Douglas, collection of  
     Antarctic photographs, 311  
 maxillosus, *Neoconocephalus*, 545  
     *Salminus*, 91  
 maxima, *Cyrtolipha*, 407  
     *Sterna*, 158, 209  
 maysi, *Epargyreus*, 501  
 Meadowlark, Cuban, 150, 151, 233, 272  
 medius, *Centropomus*, 63, 64  
 Megalomastoma, 300  
     *mani*, 315  
     *procer*, 315, 323  
 Melanchroia geometroides, 515  
 Melanerpes superciliaris, 241  
 melanoleucus, *Totanus*, 160, 211  
 "melanopygia," *Jacana*, 220  
 Melanthes otreus, var. *brunnea*, 504  
 melas, *Ancistrus*, 83  
 melanzona, *Pœcilia*, 132, 133  
 melanzonus, *Acanthophaelus*, 132, 133,  
     134  
 Melitæa frisia, 491  
 Melopelia asiatica asiatica, 161  
 Melopyrrha nigra, 159, 283  
     *taylori*, 283  
 meridionalis, *Nemobius*, 369  
     *Neoxabea*, 399, 400  
 Meristella barrisi, 25, 44  
 merlini decolor, *Saurothera*, 231  
     *Saurothera*, 161, 231  
 Merriam, Prof. J. C., 1  
 mesacostale, *Leiornhynchus*, 25, 39, 42  
 metæ, *Corydoras*, 78  
 metallica, *Camarotæchia*, 25  
 Metioche, 402  
     *americana*, 403  
 Metopium toxiferum, 153  
 Metrypa, 415  
 Metrypus, 415  
 mexicana, *Grus mexicana*, 206  
     *Rhipipteryx*, 363, 367  
     *nesiotes*, *Grus*, 158, 205  
 mexicanus, *Himantopus*, 158, 210  
     *Phalacrocorax vigua*, 158, 172  
     *Scapteriscus*, 352, 353  
 Micrathyræ æqualis, 524  
     *didyma*, 524  
     *dissocians*, 524  
 Microcentrum marginellum, 544  
 Microcyprini, 95  
 microlepis, *Anableps*, 142  
     *Hemiodus*, 87  
 micromegas, *Miogryllus*, 381  
 microps, *Imparfinis*, 82  
 micropus, *Rivulus*, 111  
 Mimocichla rubripes rubripes, 159, 253  
 Mimus orpheus, 251  
     *polyglottos orpheus*, 251  
     *polyglottos polyglottos*, 160, 251  
 minimus, *Ellipes*, 359  
 minor, *Chordeiles virginianus*, 159, 237  
     *Philohela*, 221  
     *Neocurtilla*, 349, 350  
 minutilla, *Pisobia*, 160, 211  
 minutipennis, *Hygronemobius*, 375  
 minutum, *Argiallagma*, 519  
 minutus, *Corvus*, 161  
     *Æcanthus*, 396, 397  
 Miogryllus, 377  
     *brevipennis*, 381  
     *micromegas*, 381  
     *pusillus*, 381  
 Miraguano, *Cocothrinax*, 149, 150

- misera, Catia, 507  
 Mniotilta varia, 160, 271  
 Mocis disseverans, 514  
 Mockingbird, Jamaican, 251  
 modiolaris, Modiolopsis, 339  
 Modiolopsidae, 337  
 Modiolopsis breviuscula, 326  
     exanimis, 338, 339  
     faba, 338  
     fabiformis, 329, 338  
     modiolaris, 339  
     parviuscula, 329, 330, 339  
     sowteri, 340  
     subquadrilateralis, 330, 340  
 Modiomorpha sp., 26  
 Mogoplistidae, 347, 385  
 mollicoma, Hirtella, 151  
 Mollienia caucana, 136, 137  
     latipinna, 98, 135  
     sphenops, 136  
 Mollusca, 26, 330  
 Monacanthidae, 68  
 Monacanthus oppositus, 68  
 Monbin, Spondias, 149  
 Monroe Silurian, 529  
 montana, Geotrygon, 158, 221  
 montanense, Orthoceras, 26  
 montrealensis, Clionychia, 329, 334, 335  
     Vanuxemia, 329  
 monuste, Pieris, 496  
 moreletiana, Tudora, 317  
 Morinda Roioc, 151  
 morinella, Arenaria interpres, 160, 217  
 mortuifolia, Phyllogrillus, 419  
 motacilla, Seiurus, 262, 263  
 Mountain ridges of the Isle of Pines, 149  
 mucronatus, Spirifer, 32  
 Mugil brasiliensis, 61  
     cephalus, 61  
     curema, 61  
     gaimardianus, 61  
 Mugilidae, 61  
 Mullidae, 61  
 multicolor, Todus, 159, 238  
 multicosta, Leiorhynchus, 43  
 multidentata, Fitzroyia, 140  
     Jenynsia, 140  
 multistriata pityonesica, Cepolis, 321  
 mundus, Oligoplites, 62  
 Muntingia calabura, 150  
 murceus, Centurus superciliaris, 159, 161, 241  
 Muscicapa ruticilla, 260  
 Muscipeta caribaea, 250  
 Musculium, genus, 439, 473; for index of species, cf. p. 475  
 Musonia cubensis, 543  
 muticus, Neoconocephalus, 545  
 mutus, Aphonomorphus, 424, 425  
 Myadestes elisabeth, 159, 252  
 Mycteria americana, 158, 189  
 Myiadestes elisabeth retrusus, 252  
 Myiarchus sagrae sagrae, 159, 249  
 Mylothris margarita, 496  
 mynesites, Pyramidula, 535  
 Myrmecophila, 385  
 Myrmecophilidae, 347, 384  
 Mytilarca chemungensis, 26  
 mytiloides, Ambonychia, 329  
 naeva, Erythrodiplox berenice, 524  
 naevius, Nycticorax, 186  
     Nycticorax nycticorax, 158  
 nanus, Ancyloxypha, 506  
 Napata chalybea, 512  
 nasuta, Ctenodonta, 329, 330, 341  
 "National Dinosaur Monument," 310  
 Nearctic Sphaeriid fauna, 430  
 Nannorhamdia nemacheir, 83  
 nasicus, Corvus, 255  
 nasus, Cetopsorhamdia, 83  
 naufragium, Balistes, 68  
 Nautiloidea, 26  
 nebulatus, Leimadophis, 305, 306  
 neglecta, Sturnella, 273  
 neleis, Catopsilia, 497, 498  
 nemacheir, Nannorhamdia, 83  
 Nemobiidae, 543  
     Synopsis of the South American genera, 368  
 Nemobiopsis, 385  
 Nemobius, 368  
     amazonus, 373  
     aquaticus, 370  
     brasiliensis, 371  
     chapadensis, 372  
     cubensis, 372, 543  
     longipennis, 370  
     major, 371  
     meridionalis, 369  
 Nennius, 502  
     amyntas, 502  
 Neoconocephalus, 545  
     maxillosus, 545  
     muticus, 545  
     nigropunctatus, 545  
 Neocurtilla, 349  
     borealis, 350, 351  
     claraziana, 350, 351  
     hexadactyla, 351  
         var. spinosa, 350  
     macilenta, 349  
     minor, 349, 350  
     Synopsis of South American species of, 349  
 Neoheterandria elegans, 95, 117, 118



- Neomaenis analis*, 65  
   *apodus*, 64  
   *aratus*, 65  
   *argiventris*, 65  
   *griseus*, 64  
   *mahogoni*, 65  
*Neoneura maria*, 521  
*Neotremata*, 25, 31  
*Neoxabea*, 395  
   *bipunctata*, 399, 400  
   *meridionalis*, 399, 400  
   *obscurifrons*, 399  
*Nephocetes niger niger*, 161, 244  
*nero*, *Prenes*, 509  
*nervosa*, *Gynacantha*, 522  
*nesiotes*, *Grus mexicana*, 158, 205, 206, 207, 208  
*Nesocleus fernandinae*, 161  
*Nessa*, 418  
*Netuma kessleri*, 59  
*newberryi*, *Spirifer*, 25  
*niger brachypterus*, *Holoquiscalus*, 280  
   *Cypseloides*, 244  
   *Holoquiscalus niger*, 280  
   *Nephocetes*, 161, 244  
*Nighthawk*, Cuban, 236, 237  
*nigra*, *Jacana*, 219  
   *Melopyrrha*, 159, 283  
*nigrescens*, *Centropomus*, 64  
*nigropunctatus*, *Neoconocephalus*, 545  
   *Sphaerodactylus*, 300  
*nigroventralis*, *Priapichthys*, 115  
*Nisoniades brunnea*, 504, 505  
   *zephodes*, 505  
   *otreus jamaicensis*, 505  
   *otreus*, 506  
*nitida*, *Avicennia*, 151  
   *Cyrtoxipha*, 404  
*nivalis*, *Chen hyperborea*, 159  
   *Chen hyperboreus*, 191  
*niveus discoloratus*, *Æcanthus*, 397  
*Noctua nudipes*, 234  
   *siju*, 232  
*Noctuidæ*, 513  
*Noctua hieroglyphica*, 515  
*nodulatum*, *Rhytidopoma rugulosum*, 316  
*Nomonyx dominicus*, 161  
*normale*, *Geisonoceras*, 26  
*Noropsis hieroglyphica*, 515  
*Norops ophiolepis*, 303  
*notabilis*, *Seiurus noveboracensis*, 160, 263  
*notatus*, *Sphaerodactylus*, 300, 301  
*Notodontidæ*, 515  
*noveboracensis notabilis*, *Seiurus*, 160, 263  
*Nucula*, 26  
   *levata*, 330  
   *nudipes*, *Noctua*, 234  
*Nyctalops stygius siguapa*, 235  
*Nyctanassa violacea*, 158, 187  
*Nycticorax nævius*, 186  
   *nycticorax nævius*, 186, 258  
   *vulgaris*, 186  
*Nymphalidæ*, 488  
*Nymphalinae*, 489  
*Nyridela xanthocera*, 512  
  
*Obeliscus strictus*, 320, 322, 323  
*Oberholser*, Harry, 184  
*obliquus*, *Aphonomorphus*, 425, 426  
*obscurifrons*, *Neoxabea*, 399  
*obscurus*, *Clidophorus*, 332  
   *Rivulus*, 111  
   *Tridactylus*, 356, 357  
*occidentalis*, *Ardea occidentalis*, 177  
   *Pelecanus*, 158, 173  
   *repens*, *Ardea*, 158, 176, 177  
*ochracea*, *Erythrodiplex*, 524  
*ochraceus*, *Vireo*, 256  
*ocola*, *Prenes*, 509  
*Octhodromus wilsonius rufinucha*, 216  
*Ocyurus chrysurus*, 65  
*odius*, *Aganisthōs*, 493  
*Odonata* (List) Collected on the Isle of Pines by Mr. J. L. Graf in 1910, and by Mr. G. A. Link in 1912-1913. Now Contained in the Carnegie Museum. By Hugo Kahl, 519-526  
*Odontogryllus*, 384  
*Æcanthidæ*, 347  
   Synopsis of the South American genera of, 395  
*Æcanthus*, 395  
   *argentinus*, 396  
   *brasiliensis*, 397  
   *immaculatus*, 396, 397  
   *lineolatus*, 396, 398  
   *minutus*, 396, 397  
   *niveus*, 396, 397  
   *peruvianus*, 396, 398  
   *pini*, 399  
   *tenuis*, 396, 398  
   *varicornis*, 396, 398  
   Synopsis of the South American species of, 396  
*Ædipoda fenestralis*, 545  
   *haitensis*, 545  
*Ædipodidæ*, 545  
*Oileides zephodes*, 504  
*oleacea straminea*, *Oleacina*, 319, 323  
*Oleacina* (*Lævoleacina*) *follicularis*, 319, 323  
   *oleacea straminea*, 319, 323  
   *solidula*, 319, 323  
   *subulata*, 319  
*Oligoplites altus*, 62



- Oligoplites mundus*, 62  
     *refulgens*, 62  
     *saurus*, 62  
*olisthostomus*, Gerres, 67  
*olivacea*, *Tiaris olivacea*, 159, 283  
     *Vireosylva*, 258  
*onthophagus*, *Discophogryllus*, 390  
*ophiolepis*, *Norops*, 303  
*Opisthosiphon*, 317  
*oppositus*, *Monacanthus*, 68  
*Orbiculoidea lodiensis*, 25, 31  
*Oreodoxia regia*, 150  
*Orestias*, 96  
*Orestiinae*, 96  
*orientalis*, *Vireo gundlachii*, 256  
*Oriole*, Cuban, 151, 275  
*Oriolus dominicensis*, 275  
*ornata*, *Diatrypa*, 421  
     *Helicina*, 318  
*Ornithology of the Bahama Islands*, 146  
*Orocharis*, 417  
     *saulcyi*, 423  
*orpheus*, *Mimus*, 251  
*Orphula scudderi*, 544  
*Orphulella scuddeii*, 545  
*Orthemis ferruginea*, 523  
*Orthidae*, 44  
*Orthis (Schizophoria) striatula*, 29  
     *vanuxemi*, 44  
*Orthoptera collected in the Isle of Pines*  
     by J. L. Graf, 1910, and G. A.  
     Link, St., 1912-1913. By W. J.  
     Holland and Hugo Kahl, 542-545  
*Orthopteroid insects: Synopsis of the*  
     *orders and suborders*, 345  
*Orthorhynchus ricordi*, 246  
*Ortmann, Dr. A. E.: collections of*  
     *mollusca and crustacea in Tennessee*, 4  
*Orthoceras montanense*, 26  
*oryzivorus*, *Dolichonyx*, 160, 272  
*Osborn, Mrs. Frank: silverware loaned*  
     *by*, 311  
*Osprey*, 198  
*Otocinclus spectabilis*, 78  
*otreus*, *Melanthes*, 504  
*ottawa intermedia*, *Isochilina*, 327  
*Oven-bird*, 264  
*Owl, Isle of Pines Bare-legged*, 234  
     *Pygmy*, 149, 152, 232  
     *Stygian*, 235  
     *White-winged Barn*, 235, 236  
*Owston, Alan W., Collection of Japa-*  
     *nese fishes*, 5  
*Oxyechus vociferus rubidus*, 158, 215  
     *torquatus*, 215  
     *vociferus*, 214  
*Pachylia ficus*, 511  
*Pagolla wilsonia wilsonia*, 158, 216  
*Palæanatina*, 26  
*Palæoneilo brevis*, 26  
*Paleartic Sphæriid fauna*, 430  
*pallens*, *Anaxipha*, 409, 410  
     *Schistocerca*, 545  
*palliatu*, *Hæmatopus*, 161  
*pallida*, *Anaxipha*, 408  
*pallidifrons*, *Streptoprocne zonaris*, 159,  
     245  
*palmarum*, *Amazona leucocephala*, 159,  
     161, 228  
     *Dendroica*, 160, 264  
     *Dendroica hypochrysea*, 264  
*Palmer, William*, 147, 155  
*paludosa*, *Polygyra*, 321  
*palustris*, *Pseudemys*, 300  
*Pamphila mago*, 507  
*Pamphilinae*, 506  
*panamensis*, *Felichthys*, 59  
*Pandion haliaëtus carolinensis*, 158,  
     198  
*pandrosa*, *Hemeroblemma*, 514  
*Pantala flavescens*, 526  
*pantherula*, *Helicontia*, 513  
*Papilionidæ*, 496  
*Papilio andræmon; celadon*, 500  
*Papilioninae*, 500  
*Paracyclas*, 26  
*Paræcanthus*, 416  
     *picipes*, 422  
     *vicinus*, 421, 422  
*Parænopterus*, 414  
*paræ*, *Pœcilia*, 132  
*Paragryllus*, 386, 388  
*paraguayensis*, *Parodon*, 74, 75  
*parallelus*, *Centropomus*, 64  
*Parametrypa*, 418  
*pardalis*, *Tropidophis*, 304  
*Parra cordifera*, 219  
     *gymnostoma*, 219  
     *variabilis*, 219  
     *violacea*, 219  
*parnaguæ*, *Hemiodus*, 87  
*Parodon affinis*, 71, 74, 75  
     *dariensis*, 76  
     *ecuadoriensis*, 76  
     *paraguayensis*, 74, 75  
     *piracicabæ*, 71, 72  
     *terminalis*, 76  
*Paroquet, Cuban*, 228  
*parra*, *Hæmulon*, 65  
*Parrot of Isle of Pines*, 150, 228  
*parvidens*, *Ctenodonta*, 326, 330, 340  
*parviflora*, *Sabal*, 150  
*parvipennis*, *Gryllodes*, 382  
     *Scapteriscus*, 352  
*parviuscula*, *Modiolopsis*, 329, 330, 339

- Passerculus sandwichensis savanna*, 160, 285  
*Passerina collaris*, 284  
     *cyanea*, 160, 282  
*passerina aflavida*, *Chæmepelia*, 158, 222  
     *Columbigallina*, 222  
     *Columba*, 222  
     *inornata*, *Columba*, 222  
*passerinus*, *Coturniculus savannarum*, 285  
*patao*, Gerres, 67  
*patruelis*, *Gambusia*, 99  
*Paurotus Wrightii*, 150  
 Peale, Dr. A. C., 13  
*pectinatus*, *Pristis*, 58  
*pedimacula*, *Centropomus*, 63  
*Pelecanus erythrorhynchus*, 159, 174  
     *fuscus*, 173  
     *occidentalis*, 158, 173  
*Pelecypoda*, 26, 328  
     of the Chazy formation. By Percy E. Raymond, 325-343  
*Pelican*, Brown, 173  
     White, 174  
*peltacephalus*, *Bufo*, 307  
*pensilis*, *Sylvia*, 266  
*Pentacentridæ*, 347, 385  
*pentaphylla*, *Tecoma*, 153  
*Peosina pandrosa*, 514  
*peracuta*, *Ctenodonta*, 330  
*percussus insulæ-pinorum*, *Xiphidiopicus*, 159, 161  
     *Picus*, 240  
     *Xiphidiopicus percussus*, 161  
*peregrina*, *Helminthophila*, 270  
     *Vermivora*, 270  
*peregrinus anatum*, *Falco*, 160, 195  
*Perico*, 303  
*Pericopidæ*, 514  
*Periplaneta americana*, 543  
*Perithemis domitia*, 523  
*perlata furcata*, *Strix*, 159, 235  
*Perna*, Dr. E., 29  
*perrotetti*, *Pristis*, 58  
*Persian official exhibit*, 313  
*peruviana*, *Cyrtoxipha*, 405  
*peruvianus*, *Aphonomerphus*, 425  
     *Œcanthus*, 396, 398  
*Petchary*, Cuban, 151, 248  
*petechia cruciana*, *Dendroica*, 269  
     *flaviceps*, *Dendroica*, 269  
     *gundlachi*, *Chrysocantor*, 269  
         *Dendroica*, 159, 268, 269  
*Petrochelidon fulva fulva*, 159, 259  
*Pewee*, Cuban Wood, 152, 250  
*phædra*, *Cydusia*, 513  
*Phaëthon americanus*, 161  
*Phalacrocorax auritus floridanus*, 158, 171  
*Phalacrocorax dilophus floridanus*, 172  
     *vigua mexicanus*, 158, 172  
*Phalæna pyralis florella*, 516  
     *reginalis*, 516  
*Phalangida*, 307  
*Phalangopsis*, 387  
     *annulipes*, 391, 544  
     *marmoratus*, 393  
*Phalangopsitidæ*, 347, 385, 544  
     Synopsis of the South American genera of, 386  
*Phalloceros*, 123  
     *caudomaculatus*, 94, 99, 100, 101, 124, 127  
*Phalloptychus*, 94, 120, 123  
     *eigenmanni*, 95, 121  
     *januarius*, 121, 122, 126  
     Key to the species of, 121  
*Phallostethus dunckeri*, 96  
*Phallotorynus fasciolatus*, 95, 126, 128, 129  
*Phanerotinus*, 26  
*Phemiades antiqua*, 509  
     *haitensis*, 510  
     *jamaicensis*, 510  
*philipi*, *Edmondia*, 26  
*Philohela minor*, 221  
*Philypnus dormitor*, 69  
     *maculatus*, 69  
*Phocides batabano*, 501  
*phoenicealis*, *Pyrausta*, 517  
*phœniceus*, *Agelaius*, 273, 274  
*Pholus labruscæ*, 511  
*phthisicus*, *Stenogryllus*, 415  
*phylæus*, *Hylephila*, 507  
*Phyllogryllus*, 416  
     *mortuifolia*, 419  
     *pipilans*, 419  
     *velutinus*, 419  
*Phyllopalpus*, 411  
*Phylloptera marginella*, 544  
*Phylloscirtus*, 402  
     *cicindeloides*, 410  
     *collurides*, 411  
     *similis*, 411  
*Physa cubensis*, 322, 323  
*picipes*, *Parœcanthus*, 422  
*picta*, *Eleotris*, 69  
     *Pœcilia*, 133  
*Picus percussus*, 240  
     *varius*, 240  
*Pier*, Garrett C., 312  
*Pierinæ*, 496  
*Pieris ilaire*, 496  
     *monuste*, 496  
*Piestoxiphus*, 402  
*Pigeon*, El Bobo, 227  
     Isle of Pines Plain, 225  
     Scaly-naped, 225

- Pigeon, White-crowned, 224  
 Pineria beathiana, 320, 323  
     terebra, 320, 323  
 pineria, Cerion, 320  
 pini, Ecanthus, 390  
 pinnimaculatus, Ælurichthys, 59  
     Felichthys, 59  
 pinonensis, Spirifer, 31, 32  
 Pinus caribæa, 149, 150  
 pinus, Spindalus pretrei, 281  
 Pionea fuscularis, 516  
 pipilans, Phyllogrillus, 419  
 piracicabæ, Apareiodon, 71  
     Parodon, 72  
 Pisidium, 478  
     genus, 446, 473; for index of species  
     see p. 475  
 Pisobia minutilla, 211  
 Pitangus caudifasciatus, 248  
 Pithecolobium arboreum, 152, 153  
 pittieri, Pœciliopsis, 120  
 pityonesica, Cepolis, 321  
 pityophila, Dendroica, 161  
 Planorbis lanieriana, 322  
     lucidus, 322, 323  
     redfieldi, 322  
 Platyclymenia americana, 27, 29  
     polypleura, 27  
 Platydactylus, 419  
     sauleyi, 423  
 platypterus cubanensis, Buteo, 161, 193  
 Platyzoisteria cabreræ, 542  
     finschiana, 542  
 Plegadis autumnalis, 161  
 Pleistocene fauna of California, 2  
 Pleuronectidæ, 70  
 plena, Camarotæchia, 338  
 Pleurodonte auricoma, 321, 323  
 Plover, Black-bellied, 214  
     Golden, 214  
     Semipalmated, 216  
     Wilson, 216  
 plumieri, Hæmulon, 65  
 Pluvialis dominicus dominicus, 214  
 podiceps antillarum, Podilymbus, 170  
 Podilymbus podiceps, 158, 170  
     antillarum, 170  
 Podoscirtidæ, 348, 416  
     Synopsis of the South American  
     genera of, 416  
 Podoscirtus, 417  
 Pœcilia amates, 120  
     amazonica, 131  
     branneri, 134  
     decem-maculatus, 129, 130  
     feste, 118  
     heteristia, 134  
     januarius, 122  
     melanzona, 132, 133  
 Pœcilia paræ, 132  
     picta, 133  
     reticulata, 134  
     sphenops, 136  
     vivipara paræ, 132  
 Pœciliidæ, 95  
 Pœciliid fishes:  
     Aggregations of sperm, or "spermo-  
     zeugmata," 101  
     Birth, 103  
     Breeding habits, 98  
     New genera and species, 95  
     Number of young in some vivi-  
     parous species, 103  
     Postnatal development, 97  
     References to literature, 107  
     Sex ratio, 106  
 Pœciliopsis amates, 120  
     colombiana, 120  
     pittieri, 120  
 Pœcilonetta bahamensis, 161  
 poeyanus, Spiraxis, 320  
 poeyi, Grylloides, 382  
 Poling, O. C., 5  
 poliophœa, Grus, 205  
 Polioptila cærulea cærulea, 160, 254  
 politus, Tridactylus, 358  
 Polyborus cheriway, 158, 198  
     vulgaris, 198  
 Polydactylus approximans, 61  
     virginicus, 61  
 polydamas, Papilio, 500  
 polydorus, Lyriopecten, 26  
 polyglottos, Mimus, 160, 251  
 Polygyra albolabris goodrichi, 539  
     bardenflehti, 321  
     insularum, 321  
     lingulata, 321  
     paludosa, 321, 323  
     profunda strontiana, 537, 538  
     solitaria, 540  
 polylepis, Balistes, 68  
 Polynemidæ, 61  
 Polyphemus solidulus, 319  
     subulatus, 319  
 polypleura, Platyclymenia, 27  
 Pomadasidæ, 66  
 Pomadasis branicki, 66  
     macracanthus, 66  
 porcatus, Anolis, 302  
 porosus, Crocodilus, 299  
 portoricensis, Todus, 238  
 Porzana flaviventris, 161  
 Postprolobites cephalapod zone, 29  
 pratincola furcata, Strix, 235  
 Prenes corrupta, 509  
     nero, 509  
     ocola, 509  
 presidionis, Pœcilia, 119

- pretrei pinus, Spindalus, 281  
     Spindalus, 159, 281  
     Tanagra, 281  
 Priapichthys episcopi, 116  
     nigroventralis, 115  
 Primitia logani, 327  
 Prionodesmacea, 330  
 Priotrochatella constellata, 317, 323  
     stellata, 317, 323  
 Priotelus temnurus temnurus, 159, 161  
     vescus, 161, 242  
 Pristidæ, 58  
 Pristis pectinatus, 58  
     perrotteti, 58  
 procer, Megalomastoma, 315  
 Proclamation of the President of the  
     United States, 309  
 Productella arctiostolata, 25, 28, 46  
     coloradensis, 25, 45  
         var. plicata, 25, 46  
     depressa, 25, 46  
     hirsuta, 25, 46  
     hirsutiformis, 25, 46  
     laminata, 25, 46  
     spinigera, 25, 45  
     subaculeata, 25, 46  
     subalata, 25, 46  
 Productidæ, 45  
 profunda strontiana, Polygyra, 537, 538  
 Progne cryptoleuca, 159, 260  
 Prolebias, 96  
 Proserpina globulosa, 318, 323  
 Prosthacusta, 386  
 Protambulyx strigilis carteri, 510  
 Proteides angasi, 502  
     idas var. san antonio, 502  
 proteus, Eudamus, 500  
 Protoneura amatoria, 521  
     corculum, 521  
 Protonotario citrea, 271  
 Protoparce rustica, 510  
     sexta, 510  
 Protremata, 25, 44  
 Prolobites simplex, 27, 29  
 proxima, Columba inornata, 161, 225,  
     226  
 pruinosa, Urocoptis, 320  
 Pseudancistrus carnegiei, 83  
 Pseudemys palustris, 300  
 Pseudogryllus, 414  
     elongatus, 415  
 pseudogula, Eucinostoma, 67  
 Pseudoneuroptera, 526  
 Pseudopœcilia, 118  
     festæ, 119  
     fria, 95, 105, 119  
 Psinidia fenestralis, 545  
 Psittacus leucocephalus, 228  
 Pterinopecten imbecilis, 26  
 Pterinopecten vertumnus, 26  
 Pterotheca expansa, 332  
 Pthonia cylindrica, 26  
 Ptiloxena atrovioleacea, 159, 276  
 pulicaria, Rhipipteryx, 363, 367  
 Pullman Palace Car model, 312  
 punctatus, Rivulus, 111  
 punctulatus, Hippocampus, 60  
 punicifolia, Eugenia, 151  
 Pupidæ, The, 315  
 pupoides, Tudora, 317  
 pusillus, Ereunetes, 211  
     Miogryllus, 381  
 pustulipes, Gryllodes, 382  
 Put-in-Bay, shells of, 532  
 pygogramma, Fitzroyia, 140, 142  
 Pyramidula alternata eriensis, 532, 535  
     solitaria albina, 533  
         mynesites, 535  
         roseo-apicata, 534  
         strontiana, 532, 535  
 Pyrausta cardinalis, 517  
     phœnicealis, 517  
 pyrogramma, Fitzroyia, 142  
 Querquedula discors, 159, 190  
 quiscula aglæus, Quiscalus, 277  
 Quiscalus atro-violaceus, 276  
     barytus, 276  
     gundlachi, 276, 279  
     quiscula aglæus, 277  
 Raborocado, 303  
 radiatilis, Ancyclus, 322  
 Rail, Cuban King, 153, 200  
     Isle of Pines Clapper, 151, 201  
     Virginia, 202  
 Rallus elegans ramsdeni, 158, 200  
     longirostris cubanus, 161  
     leucophœus, 158, 161, 201  
     waynei, 202  
 Ramsden, Charles T., 147, 176, 242, 282  
 ramsdeni, Cyanerpes cyaneus, 161  
     Rallus elegans, 158, 200  
 Raven, 255  
 Raymond, Dr. P. E., 24, 30  
     The Pelecypoda of the Chazy  
         formation, 325-343  
 raymondi, Spirifer, 25, 31, 32  
 Read, Arthur C., 147, 156, 157  
 Redstart, 260  
 Red-wing, 153, 273  
 Reed, William H., 2  
 reflexa, Ampullaria, 322  
 refulgens, Oligoplites, 62  
 regia, Oreodoxia, 150  
 reginalis, Sylepta, 516  
 Remigia disseverans, 514  
 repens, Ardea herodias, 178

- repens, *Ardea occidentalis*, 158, 176, 177  
 Reptiles and Amphibians of the Isle  
 of Pines, by Thomas Barbour, 297-  
 308  
 reticularis, *Atrypa*, 29  
 reticulata, *Pœcilia*, 134  
 reticulatus, *Lebistes*, 95, 105, 134, 135  
 retrusus, *Myiadestes elisabeth*, 252  
*Rhinobatidæ*, 58  
*Rhinobatus leucorhynchus*, 58  
*Rhipidomella vanuxemi*, 25, 28, 44  
*Rhipipteryx*, 354  
   *atra*, 361  
   *biolleyi*, 363  
   *boliviana*, 361, 364  
   *brullei*, 362, 366  
   *carbonaria*, 361  
   *circumcincta*, 361, 364  
   *cruciata*, 362, 365  
   *cyanipennis*, 362  
   *forceps*, 361, 363  
   *fraterna*, 363  
   *hydrodroma*, 361  
   *limbata*, 361  
   *marginata*, 362  
   *marginipennis*, 362, 367  
   *mexicana*, 363, 367  
   *pulicaria*, 363, 367  
   *pulicaria var. peruviana*, 367  
   *rivularia*, 362, 366  
   *scrofulosa*, 363  
   *tricolor*, 363  
   *trilobata*, 362, 365  
   Synopsis of the species of, 361  
*Rhopalocera*, 488  
*Rhytidopoma rugulosum*, 316, 323  
   *clathratum*, 316, 323  
   *nodulatum*, 316, 323  
*Rhizophora mangle*, 151  
*rhombeus*, *Gerres*, 66  
*rhombifer*, *Crocodylus*, 299  
*Rhynchonella acuminata*, 29  
   (*Stenocisma*) *contracta*, 43  
*Rhynchonellidæ*, 38  
*Riccordia ricordii ricordii*, 159, 246  
 Richmond, Dr. Charles W., 147  
*ricordii*, *Eleutherodactylus*, 308  
   *Orthorhynchus*, 246  
   *Riccordia*, 159, 246  
 Ridgway, Robert, 147, 169  
 Riley, Joseph H., 147, 155  
 "Rincon" Lagoon, 152  
*Riparia riparia*, 259  
*rivularia*, *Rhipipteryx*, 362, 366  
*Rivulus brevis*, 112  
   *compressus*, 95, 111  
   *cylindraceus*, 108  
   *elegans*, 108, 109  
   *godmani*, 108  
   *hartii*, 108  
   *holmiæ*, 110  
   *magdalenæ*, 95, 109  
   *micropus*, 111  
   *obscurus*, 111  
   *punctatus*, 111  
*roberti*, *Hyporhamphus*, 60  
*robinsoni*, *Cherocampa*, 510  
   *Xylophanes*, 511  
 Rodriguez, Señor V. J., 297  
 Roio, Morinda, 151  
*roseo-apicata*, *Pyramidula*, 534  
*Rostrhamus sociabilis*, 158, 192  
*rousseau*, *Siphostoma*, 60  
*ruber*, *Phœnicopteris*, 158, 189  
*rubidus*, *Oxyechus vociferus*, 158, 215  
*rubripes*, *Mimocichla*, 159, 253  
*Ruedemann*, *Rudolf*, 325  
*rufescens*, *Dichromanassa*, 158, 179  
*ruficollis*, *Ardea tricolor*, 158, 181  
*rufimentum*, *Hydranassa tricolor*, 181  
*rufinucha*, *Oethodromus wilsonius*, 216  
*rufipennis*, *Luzara*, 388  
*rufinervis*, *Dythemis*, 525  
*rugulosum nodulatum*, *Rhytidopoma*,  
   316  
*rustica*, *Protoparce*, 510  
*ruticilla*, *Setophaga*, 160, 260  
  
*Sabal parviflora*, 150  
*sagræ*, *Myiarchus*, 249  
   *Myiarchus sagræ*, 159  
*sagrei*, *Anolis*, 301  
*Salamanquesa*, 301  
*Salamatquita de la Virgen*, 301  
*Salminus affinis*, 91, 92  
   *brevidens*, 91  
   *hilarii*, 91, 92  
   *maxillosus*, 91  
   Key to the species of, 91  
*Salmoperce*, *The*, 96  
*Saltatoria*, 345  
*Samea zinghalis*, 516  
*sandarac*, *Asbolis*, 509  
*Sandpiper*, *Least*, 211  
   *Semipalmated*, 211  
   *Spotted*, 213  
*sandvicensis acuflavida*, *Sterna*, 160,  
   209  
*Sandy plain of the Isle of Pines*, 149  
*santiago*, *Eudamus*, 500  
*sapo de concha*, 308  
*saturatus*, *Butorides virescens*, 185  
*Satyrina*, 494  
*sauleyi*, *Orocharis*, 423  
*Saurothera bahamensis*, 231  
   *decolor*, 159, 161, 231  
   *merlini*, 161, 231  
   *decolor*, 231



- saurus, *Oligoplites*, 62  
 savanna, *Passerculus sandwichensis*, 160, 285  
 savannarum, *Ammodramus*, 161  
     *australis*, *Ammodramus*, 160, 285  
     *Fringilla*, 285  
 scala, *Cyrtodonta*, 333  
 Scapteriscus, 349  
     *abbreviatus*, 352  
     *agassizi*, 352  
     *borellii*, 352, 353  
     *camerani*, 352  
     *didactylus*, 352, 353  
     *mexicanus*, 352, 353  
     *oxydactylus*, 352  
     *parvipennis*, 352  
     *tenuis*, 352  
     *variegatus*, 352  
     *vicinus*, 352, 354  
     Synopsis of the South American species of, 352  
 Scaridæ, 68  
 Scarus *croicensis*, 68  
 Schistocerca, 546  
     *inscripta*, 546  
     *pallens*, 546  
 Schizodus *appressus*, 26  
 Schizophoria *striatula* var. *australis*, 25, 44  
 Schuchertella *chemungensis* var. *arcto-striata*, 25, 45  
     *crenistris*, 25  
     *inflata*, 25, 28  
 Sciadeichthys *troscheli*, 59  
 Sciaenidæ, 67  
 scitulleps, *Synodus*, 59, 60  
 sciurus, *Hæmulon*, 65  
 scitulleps, *Synodus*, 60  
 scopulorum, *Eutrochatella*, 318  
 scrofulosa, *Rhipipteryx*, 363  
 scudder, *Hæmulon*, 65  
     *Orphulella*, 545  
 Seiurus *aurocapillus*, 160, 264  
     *motacilla*, 262, 263  
     *noveboracensis notabilis*, 160, 263  
 Selene *vomer*, 62  
 semipalmata, *Symphemia*, 212  
 semipalmatus, *Catoptrophorus semipalmatus*, 160, 212  
     *Charadrius*, 160, 216  
 septentrionalis, *Cathartes aura*, 192  
     *Hyla*, 307  
 Serranidæ, 64  
 Sesia *fadus*, 511  
 setipinnis, *Vomer*, 63  
 Setochalcis *cubanensis*, 159, 238  
 Setophaga *ruticilla*, 160, 260  
 sexta, *Protoparce*, 510  
 Shah Abbas, 314  
 Shells: Notes on Land-shells of the Islands of the Western End of Lake Erie and Descriptions of New Varieties. By George H. Clapp, 532-541  
     List of Land and Fresh-water Shells of the Isle of Pines. By John B. Henderson, 315-324  
 Shells found at East Sister Island, Ontario, 531  
     Green Island, Ohio (Formerly Strontian Island), 530  
     Middle Island, Ontario, 530  
     Middle Sister Island, Ontario, 531  
     Mouse Island, Ohio, 531  
     North Harbor Island, Ontario, 531  
     West Sister Island, Ohio, 530  
 Shimer, H. W., 24  
 Siderone *ide*, 493  
 sigillatus, *Gryllodes*, 382, 544  
 siju, *Glaucidium siju*, 161, 232  
     *Noctua*, 232  
     *vittatum*, *Glaucidium*, 159, 161  
 silens, *Aphonomorphus*, 424, 425  
 Siluridæ, 58  
 simillimus, *Gerres*, 66  
 similis, *Phylloscirtus*, 411  
 simonsi, *Galeichthys*, 58  
 simplex, *Prolobites*, 27  
     *Tornoceras*, 29  
 simplicicollis, *Erythemis*, 525  
 Siphostoma *eigenmanni*, 60  
     *rousseau*, 60  
 Smith, Hugh M.: Appreciation of editorial work, 313  
 Snails, food for chickens, 528  
     Paradise of, 528  
 Snipe, Wilson, 210  
 sociabilis, *Rostrhamus*, 158, 192  
 sociale, *Leptodesma*, 26  
 solidula, *Oleacina*, 319  
 Solitaire, Cuban, 252, 253  
     Isle of Pines, 253  
 solitaria, *Pyramidula albina*, 533  
     *Cyrtodonta*, 332  
     *Polygyra*, 540  
     *strontiana*, *Pyramidula*, 532, 535  
     *Tringa*, 160  
     *Tringa solitaria*, 212  
 solox, *Lyriopecten*, 26  
 saporator, *Gobius*, 70  
 South American Crickets, *Gryllotalpoidea*, and *Achetoides*. By Lawrence Bruner, 344-428  
 Sowter, T. W. E., 339  
 sowteri, *Modiolopsis*, 340  
 Sowteria *canadensis*, 326, 342



- Sparidae, 66  
 Sparrow, Grasshopper, 285  
     Savannah, 285  
 sparveria dominicensis, Cerchneis, 195  
 sparverioides, Falco, 158, 195, 196  
 sparverius, Falco, 195, 196, 197  
 Spathella typica, 26  
 spectabilis, Otocinclus, 78  
 spelæus, Amblyopsis, 97  
 Sphæriidæ, 431  
     Collecting and collecting outfit, 479, 480  
     Drift-heaps containing, 483  
     Fossil species of, 431, 483  
     Method of making collecting net with cheap ring, 480  
     Preliminary catalog of the North American, By Victor Sterki, 429-477  
     Preservation of, 484  
     Shipping for identification, 485  
     Time for collecting, 482  
     Variation in species, 429  
     Well-known only from limited area of Western Continent, 478  
     and Aquatic Gastropods: suggestions for collecting, 478-486  
 Sphærium, genus, 431, 472; for index of species see p. 475  
 Sphærodactylus elegans, 300  
     cinereus, 301  
     nigropunctatus, 300  
     notatus, 300, 301  
 Sphagebranchus anguiformis, 55, 56  
     conklini, 55, 56  
 sphenops, Mollienisia, 136  
     Pœcilia, 136  
 Spheroides annulatus, 69  
     testudineus, 69  
 Sphingidæ, 510  
 Sphingoidea, 510  
 Sphingonotus haitensis, 545  
 Sphinx alope, 511  
     fadius, 511  
     ficus, 511  
     cingulata, 510  
     labruscæ, 511  
     lugubris, 511  
     medor, 510  
     rustica, 510  
     sexta, 510  
     tersa, 511  
 Sphyrapticus varius varius, 160, 240  
 Sphyrna tiburo, 58  
 Sphyrnidæ, 58  
 Spindalis, Cuban, 149, 152, 281  
     pretrei, 159  
     pinus, 281  
 spinigera, Productella, 25, 45  
 spinosa, Fulica, 217, 218  
     gymnostoma, Jacana, 220  
     Jacana, 220  
 Spiraxis poeyana, 323  
     (Glandinella) poeyanus, 320  
 Spirifer archiaci, 29  
     argentarius, 31, 32  
     conoideus, 29  
     cuspidatus, 25  
     disjunctus, 29, 33, 34, 35, 36  
         var. animasensis, 34  
     elegans, 32  
     mucronatus, 32  
     newberryi, 25  
     pinonensis, 31, 32  
     raymondi, 25, 31, 32  
     subequalis, 25  
     whitneyi, 25, 28, 33, 34, 35, 36, 38  
         var. animasensis, 25, 34  
         gallatinensis, 25, 35  
         monticola, 25, 36, 37  
 Spiriferidæ, 31  
 Spondias Monbin, 149  
 sponsa, Aix, 161, 191  
 Spoonbill, Roseate, 188  
 "Spur-winged Water-hen," 219  
 squamosa, Anona, 151  
     Columba, 158, 225, 227  
     inornata, Columba, 158, 225, 227  
 Squatarola squatarola, 160, 214  
 Starnænas cyanocephala, 158, 220  
 Steinbach, José, 312  
 steindachneri, Gnathocharax, 79  
 Stejneger, Dr. Leonhard, 297  
 stellata, Priotrochatella, 317  
 Stenaphonus, 417  
 steneles, Victorina, 494  
 Stenœcanthus, 417  
 Stenogryllidæ, 348  
     Synopsis of the genera of South American, 414  
 Stenogryllus, 41, 415  
     phthisicus, 415  
 Stenogyridæ, 315  
 Sterna anætheta, 161  
     antillarum, 158  
     cayennensis, 209  
     dougalli, 161  
     fuscata, 161  
     maxima, 158, 209  
     sandvicensis acuffavida, 160, 209  
 Sterki, Victor, A Preliminary Catalog of the North American Sphæriidæ, 429-477  
 Stethapirion crenatus, 77, 80, 81  
 stilbe, Astyanax, 89  
 Stilt, Black-necked, 210  
 stolidus, Anous stolidus, 161  
 straminea, Oleacina oleacea, 319

- Streptoceryle alcyon alcyon*, 160, 239  
*Streptoprocne zonaris pallidifrons*, 159, 245  
*Streptorhynchus chemungensis* var. *arcostriata*, 45  
*striata*, *Dendroica*, 163, 265  
*striatula* var. *australis*, *Schizophoria*, 25, 44  
*Orthis*, 29  
*striatus* *fringilloides*, *Accipiter*, 161  
*strigilis carteri*, *Protambulyx*, 510  
*Strix fuscata*, 235  
*pratricula fuscata*, 235  
*strontiana*, *Polygyra profunda*, 537, 538  
*Pyramidula solitaria*, 532, 535  
*Strophomenacea*, 44  
*Strophomenidae*, 45  
*Sturnella argutula*, 272  
*hippocrepis*, 272  
*magna hippocrepis*, 159, 272  
*neglecta*, 273  
*stygius*, *Asio*, 159, 235  
*signapa*, *Nyctalops*, 235  
*subaculeata*, *Productella*, 25, 46  
*subalata*, *Productella*, 25, 46  
*subarcuata*, *Grammysia*, 26  
*subcarinata*, *Cyrtodonta*, 329  
*subequalis*, *Spirifer*, 25  
*sublamellosa*, *Cleiothyridina*, 25  
*subniger*, *Agelaius*, 273, 274  
*subquadrilateralis*, *Modiolopsis*, 330, 340  
*subrecta*, *Goniophora*, 26  
*subreniformis*, *Camarophoria*, 29, 42  
*subulata*, *Oleacina*, 319  
*Sula leucogastra*, 161  
*superciliaris*, *Centurus superciliaris*, 161  
*Colaptes*, 241  
*Melanerpes*, 241  
*murceus*, *Centurus*, 159, 161  
*surinamensis*, *Eneoptera*, 413  
*swainsonii*, *Hylocichla ustulata*, 254  
*Swallow*, *Bank*, 259  
*Barn*, 258  
*Cuban Cliff*, 149, 259  
*Rough-winged*, 259  
*Swift*, *Antillean Collared*, 245  
*Black*, 244  
*Cuban Palm*, 245  
*Sylepta reginalis*, 516  
*sylvestris*, *Casearia*, 149  
*Sylvia pensilis*, 266  
*trichas*, 261  
*virens*, 267  
*Symphemia semipalmata*, 212  
*Symphyloxiphus*, 402  
*magnificum*, 410  
*Synchromia cardinalis*, 517  
*Syngamia florella*, 516  
*Syngnathidae*, 60  
*Synodontidae*, 59  
*Synodus scituleps*, 59, 60  
*jenkinsi*, 59  
*Syntomidae*, *auctorum*, 512  
*syrichtus*, *Hesperia*, 506  
*Syringothyris carteri*, 25, 27, 28  
*Tabebuia lepidophylla*, 150  
*Table* indicating the distribution of land and fresh-water shells of the Isle of Pines, 323  
*Tachornis phaeocobia yradii*, 159, 245  
*Tachyris ilaire*, 496  
*Tafalica*, 418  
*lineatipes*, 415  
*lurida*, 416  
*Tanagra pretrei*, 281  
*Tantalus loculator*, 189  
*Tarentola*, 301  
*taylori*, *Melopyrrha*, 283  
*Teal*, *Blue-winged*, 190  
*Tecoma pentaphylla*, 153  
*Telegonus cassander*, 503, 504  
*gerona*, 503  
*habana*, 503  
*hahneli*, 503, 504  
*Telotrema*, 25, 31  
*telskii*, *Aphonomorphus*, 425  
*temnurus*, *Trogon*, 242  
*vescus*, *Priotelus*, 161, 242  
*tenuatus*, *Lestes*, 519  
*tenuilabris*, *Helicina*, 318  
*tenuis*, *Ecanthus*, 396, 398  
*Scapteriscus*, 352  
*Terebra*, *Pineria*, 320  
*Teretistris fernandina*, 159, 262  
*Terias amelia*, 499  
*citrina*, 498  
*dina*, 498  
*elathea*, 499  
*euterpe*, 499  
*lisa*, 499  
*terminalis*, *Apareiodon*, 71  
*Parodon*, 76  
*Tern*, *Cabot*, 209  
*Least*, 209  
*Royal*, 209  
*rookery*, 528  
*Ternstromia obovalis*, 152  
*testaceus*, *Aphonomorphus*, 425  
*testudineus*, *Spheroides*, 69  
*Tetraodontidae*, 69  
*Tetrazygia bicolor*, 152  
*Tettigonoidea*, 346  
*Thamnoscirtus*, 402  
*cicindeloides*, 410  
*vittatus*, 411  
*Thanaos velasquez*, 506

- Thecla columella*, 495  
     *favonius*, 495  
     *martialis*, 495  
*theonus*, *Lycæna*, 495  
*Thespis cubensis*, 543  
*Tholymis citrina*, 526  
*Thrush*, Grinnell Water-, 263  
     Louisiana Water-, 262  
     Olive-backed, 254  
     Red-legged, 149, 152, 253  
*thula*, *Egretta thula*, 158, 180  
 "Thunder-snakes," 305  
*Thymelicus nanus*, 506  
*Thysanophora boothiana*, 321, 323  
*Tiaris canora*, 284, 285  
     *olivacea olivacea*, 159, 283  
*tibialis*, *Cyrtoxipha*, 405  
     *Laranda*, 387, 388  
*tiburo*, *Sphyrna*, 58  
*tigrina*, *Dendroica*, 269  
*timais*, *Xanthopastis*, 513  
*Timetes eleucha*, 493  
*timidus*, *Aphonomorphus*, 424  
 "Tocororo," 244  
 Todd, W. E. C., *The Birds of the Isle of Pines*, 146-296  
*Todus multicolor*, 159, 238  
     *portoricensis*, 238  
 Tody, Cuban, 149, 238  
*Tolmarchus caudifasciatus*, 159, 248  
*Tornoceras crebrisepium*, 27  
     *douglasi*, 27  
     *simplex*, 29  
*torquatus*, *Oxyechus vociferus*, 215  
*Tortoise*, description of a new species from the Jurassic of Utah. By Charles W. Gilmore, 7-12  
*Tortricidæ*, 517  
*Totanus flavipes*, 160, 212  
     *melanoleucus*, 160, 211  
*toxiferum*, *Metopium*, 153  
*Trachinotus culveri*, 62  
     *fasciatus*, 62  
     *glaucus*, 62  
*Trachycorystes fisheri*, 82  
*Tramea insularis*, 526  
*tranceps*, *Endodesma*, 337  
*Tretanorhinus insule-pinorum*, 306  
     *variabilis*, 306  
*trichas*, *Geothlypis trichas*, 160, 261  
     *ignota*, *Geothlypis*, 261  
     *Sylvia*, 261  
*Trichilia hirta*, 149  
*tricolor*, *Ara*, 159, 227  
     *Rhipipteryx*, 363  
     *ruficollis*, *Ardea*, 181  
     *Hydranassa*, 158, 181  
*Tridactylidæ*, 348  
     Habitat of, 355  
*Tridactylidæ*, Synopsis of the South American genera of, 354  
*Tridactylus*, 354  
     *atratus*, 356, 357  
     *australis*, 356, 357  
     (*Heteropus*) *histrion*, 359  
     *marginatus*, 366  
     *obscurus*, 356, 357  
     *politus*, 356, 358  
     Synopsis of South American species of, 356  
*Trigonidiidæ*, 348  
     Synopsis of the genera with special reference to Tropical America, 401  
*Trigonidium*, 401  
     *pallens*, 409  
*trilobata*, *Rhipipteryx*, 362, 365  
*Tringa solitaria*, 160, 212  
*tripuncta*, *Lerodea*, 508  
*Trogon*, Isle of Pines, 149, 152, 242  
     *temnurus*, 242  
*Tropidophis pardalis*, 304  
*trocheli*, *Sciadeichthys*, 59  
*Truxalidæ*, 545  
*Tschernyschew*, Dr. Th., 28  
*tuberculata*, *Diatrypa*, 421  
*Tudora moreletiana*, 317, 323  
     *pupoides*, 317, 323  
*Turdus carolinensis*, 252  
*Turkey*, Water, 171  
*Turnstone*, Ruddy, 217  
*tutolia*, *Amblyscirtes*, 508  
*typica*, *Eopteria*, 336  
*Tyrannus cubensis*, 159, 247  
     *dominicensis dominicensis*, 159, 247  
     *magnirostris*, 247  
*Turtles* (Morrison Beds), most ancient in North America, 7  
*Tyto perlata furcata*, 159, 235  
  
*Ululodes hyalinus*, 526  
*umbrata*, *Erythrodiplax*, 525  
*Umbrina tumacoensis*, 67  
*umbrinus*, *Buteo borealis*, 161  
*undata*, *Whiteavis*, 337  
*undecimalis*, *Centropomus*, 64  
*unimaculatus*, *Archosargus*, 66  
*uninotatus*, *Girardinus*, 122  
*Upeneus grandisquamis*, 61  
*Urania boisduvali*, 515  
*Uranidæ*, 515  
*Uranophora chalybea*, 512  
*Urocoptis* (*Gongylostoma*) *pruinosa*, 320, 323  
*urophthalmus*, *Rivulus*, 110  
*uruba*, *Catharista*, 191  
*Urubitinga anthracina*, 193, 194  
     *gundlachi*, 158, 193, 194

- usneæ*, *Compsothlypis americana*, 160,  
 270  
*ustulata swainsonii*, *Hylocichla*, 254  
*utahense*, *Leiorhynchus*, 41  
     *var. ventricosum*, *Leiorhynchus*,  
     25, 40, 42  
*Utetheisa venusta*, 512  
  
*Vanessa lytrea*, 492  
*vanillæ*, *Dione*, 490  
*Vanuxemia limbata*, 338  
     *montrealensis*, 329  
*vanuxemi*, *Orthosia*, 44  
     *Rhipidomella*, 25, 28, 44  
*variabilis*, *Parra*, 219  
     *Tretanorhinus*, 306  
*varia*, *Mniotilta*, 160, 271  
*varicornis*, *Ecanthus*, 396, 398  
*variegata*, *Cyrtosiphia*, 404  
     *Helicina*, 318  
*variegatus*, *Aphonomorphus*, 424  
     *Scapteriscus*, 352  
*varius*, *Sphyrapicus varius*, 240  
*velutinus*, *Phyllogryllus*, 419  
*venusta*, *Utetheisa*, 512  
*verbenata*, *Erythemis*, 525  
*Vermivora bachmani*, 270  
     *peregrina*, 270  
*vermivorus*, *Helmitheros*, 271  
*vertumnus*, *Pterinopecten*, 26  
*vescus*, *Priotelus temnurus*, 159, 161,  
     242  
*vesiculosa*, *Erythemis*, 525  
     *Lepthemis*, 525  
*vicinus*, *Paræcanthus*, 421, 422  
     *Scapteriscus*, 352, 354  
*Victorina steneles*, 493  
     *insularis*, 494  
*vigua mexicanus*, *Phalacrocorax*, 158,  
     172  
*violacea*, *Jacana spinosa*, 158, 217  
     *Nyctanassa*, 158, 187  
     *Parra*, 219  
*virens*, *Æschna*, 523  
     *Dendroica*, 160, 267  
     *Sylvia*, 267  
*Vireo*, *carmioli*, 256  
     *crassirostris*, 256  
     *gundlachi gundlachii*, 159, 255, 256  
         *orientalis*, 256  
     *ochraceus*, 256  
     *griseus griseus*, 160  
     *Black-whiskered*, 149, 152, 257  
     *Gundlach's*, 255  
     *Red-eyed*, 258  
     *White-eyed*, 256  
     *Yellow-throated*, 257  
*Vireosylva calidris barbatula*, 159, 257  
     *calidris*, 257  
  
*Vireosylva olivacea*, 258  
*virescens*, *Ardea*, 182  
     *cubanus*, *Butorides*, 158, 183, 186  
*virginianus*, *Chordeiles*, 236  
     *Chordeiles virginianus*, 160  
     *Colinus*, 199  
     *minor*, *Chordeiles*, 159, 236, 237  
*virginicus*, *Polydactylus*, 61  
*viridis*, *Centropomus*, 64  
*vittatum*, *Glaucidium siju*, 159, 161, 232  
     233  
     *Thamnoscirtus*, 411  
*vittatus*, *Liocephalus*, 304  
*vivipara*, *Pœcilia*, 97, 98, 131, 132  
*vocifera*, *Ægialitis*, 215  
*vociferus*, *Antröstomus*, 238  
     *Aramus*, 158, 204  
     *Caprimulgus*, 238  
     *Oxyechus vociferus*, 160, 214  
*Vomer*, *setipinnis*, 63  
*vomer*, *Selene*, 62  
*vulgaris*, *Nycticorax*, 186  
     *Polyborus*, 198  
*Vulture*, Southern Turkey, 191  
  
*waimacui*, *Rivulus*, 110  
*Walker*, Dr. Bryant, 431, 527, 532  
*Warbler*, *Bachman*, 270  
     *Blackburnian*, 267  
     *Black-poll*, 265  
     *Black-throated Blue*, 268  
     *Black-throated Green*, 267  
     *Black and White*, 271  
     *Cape May*, 269  
     *Cerulean*, 267  
     *Cuban Yellow*, 269  
     *Fernandina*, 262  
     *Magnolia*, 269  
     *Myrtle*, 268  
     *Northern Parula*, 270  
     *Palm*, 264  
     *Prairie*, 265  
     *Prothonotary*, 271  
     *Worm-eating*, 271  
     *Tennessee*, 270  
     *Yellow-throated*, 151, 266  
*wardi*, *Ardea herodias*, 177  
*waynei*, *Rallus longirostris*, 202  
*Wedekind*, Dr. R., 29  
*Weed*, Dr. W. H., 22  
*Whip-poor-will*, *Cuban*, 238  
*whitneyi*, *Spirifer*, 28, 33, 34, 35, 38  
*Whiteavsia*, *undata*, 337  
     *expansa*, 337  
*whiteavsiana*, *Helicotoma*, 326  
*wilcoxi*, *Chondropoma*, 316  
*Willet*, 212  
*Wilson*, Charles, Some marine fishes  
     from Colombia and Ecuador, 57-70

- wilsonia*, *Pagolla wilsonia*, 158, 216  
*wilsonius rufinucha*, *Oethodromus*, 216  
 Woodpecker, Isle of Pines, 150, 241  
     Isle of Pines Green, 152, 240  
     Yellow-bellied, 240  
 Wortman, Jacob L., 3  
 Wrightii, *Paurotis*, 150  
  
*xanthocera*, *Nyridela*, 512  
*Xanthopastis timais*, 513  
*Xantornus dominicensis*, 275  
*Xiphidiopicus percussus insulæ-pinorum*, 159, 161, 240  
*Xya*, 355  
     *notata*, 366  
*Xylophanes robinsoni*, 511  
     *tersa*, 511  
  
*Xylopia grandiflora*, 152  
  
 Yellow-legs, 212  
     Greater, 211  
*yradii*, *Tachornis phænicobia*, 159, 245  
  
 Zappey, Walter R., 147, 155  
*Zenaida zenaida zenaida*, 158, 222, 223  
*Zenaidura carolinensis marginata*, 223  
     *macroura*, 158, 223  
     *macroura bella*, 223  
     *marginata*, 223  
*zinghalis*, *Crocidophora*, 516  
*zonaris pallidifrons*, *Hemiprocnæ*, 245  
     *Streptoprocne*, 159, 245  
*Zonitidæ*, 315  
*Zygoptera*, 519







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## CONTENTS

Editorial Notes . . . . .	I
I. Description of a New Species of Tortoise from the Jurassic of Utah. By CHARLES W. GILMORE . . . . .	7
II. The Fauna of the Upper Devonian in Montana. By W. P. HAYNES . . . . .	13
III. Description of a New Sphagebranchus from the Ba- hamas. By C. H. EIGENMANN . . . . .	55
IV. Some Marine Fishes from Colombia and Ecuador. By CHARLES WILSON . . . . .	57
V. On Apareiodon, a New Genus of Characid Fishes. By CARL H. EIGENMANN . . . . .	71
VI. New or Rare Fishes from South American Rivers. By CARL H. EIGENMANN . . . . .	77
VII. Description of Three New Species of Characid Fishes. By CARL H. EIGENMANN AND ARTHUR W. HENN . . . . .	87
VIII. On the Species of Salminus. By CARL L. EIGEN- MANN . . . . .	91
IX. On Various South American Pœciliid Fishes. By ARTHUR W. HENN . . . . .	93
X. A New Species of Apatosaurus. By W. J. HOLLAND . . . . .	143
XI. The Birds of the Isle of Pines. By W. E. CLYDE TODD . . . . .	146
XII. The Reptiles and Amphibians of the Isle of Pines. By THOMAS BARBOUR . . . . .	297

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## CONTENTS

	Editorial Notes	309
XIII.	A List of the Land and Fresh-water Shells of the Isle of Pines. By JOHN B. HENDERSON	315
XIV.	The Pelecypoda of the Chazy Formation. By PERCY E. RAYMOND	325
XV.	South American Crickets, Gryllotalpoidea, and Achetoidea. By LAWRENCE BRUNER	344
XVI.	A Preliminary Catalog of the North American Sphæriidæ. By VICTOR STERKI, M.D.	429
XVII.	Some Directions and Suggestions for Collecting the Sphæriidæ and Aquatic Gastropods. By VICTOR STERKI, M.D.	478
XVIII.	The Lepidoptera of the Isle of Pines, Being a List of the Species Collected on the Island by Mr. J. L. Graf, in 1910, and Mr. G. A. Link, Sr., in 1912-1913. By W. J. HOLLAND	487
XIX.	A List of the Odonata Collected on the Isle of Pines by Mr. J. L. Graf in 1910, and by Mr. G. A. Link in 1912-1913, Now Contained in the Carnegie Museum. By HUGO KAHL	519
XX.	A Trip to Islands in Lake Erie. By CALVIN GOODRICH	527
XXI.	Notes on the Land-shells of the Islands at the Western End of Lake Erie and Description of New Varieties. By GEORGE H. CLAPP	532
XXII.	A List of the Orthoptera Collected in the Isle of Pines by J. L. Graf, 1910, and G. A. Link, 1912-1913. By W. J. HOLLAND AND HUGO KAHL	542
	Index	547











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